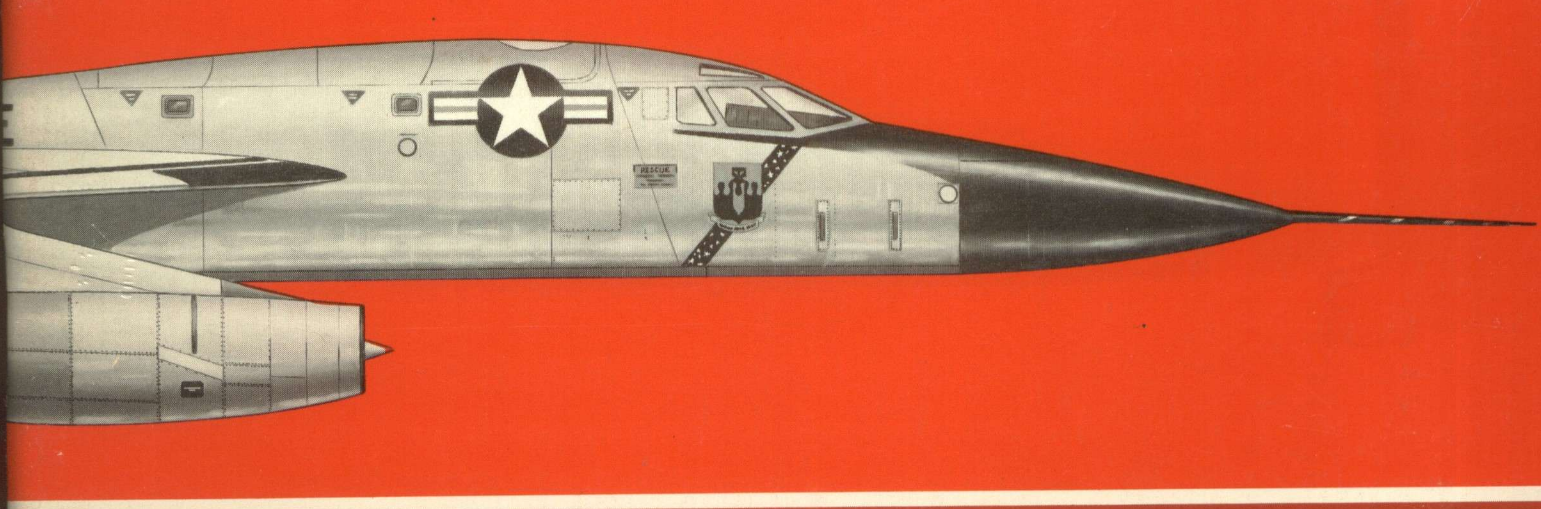
The B-58 HUSTLER

by Douglas H. Robinson



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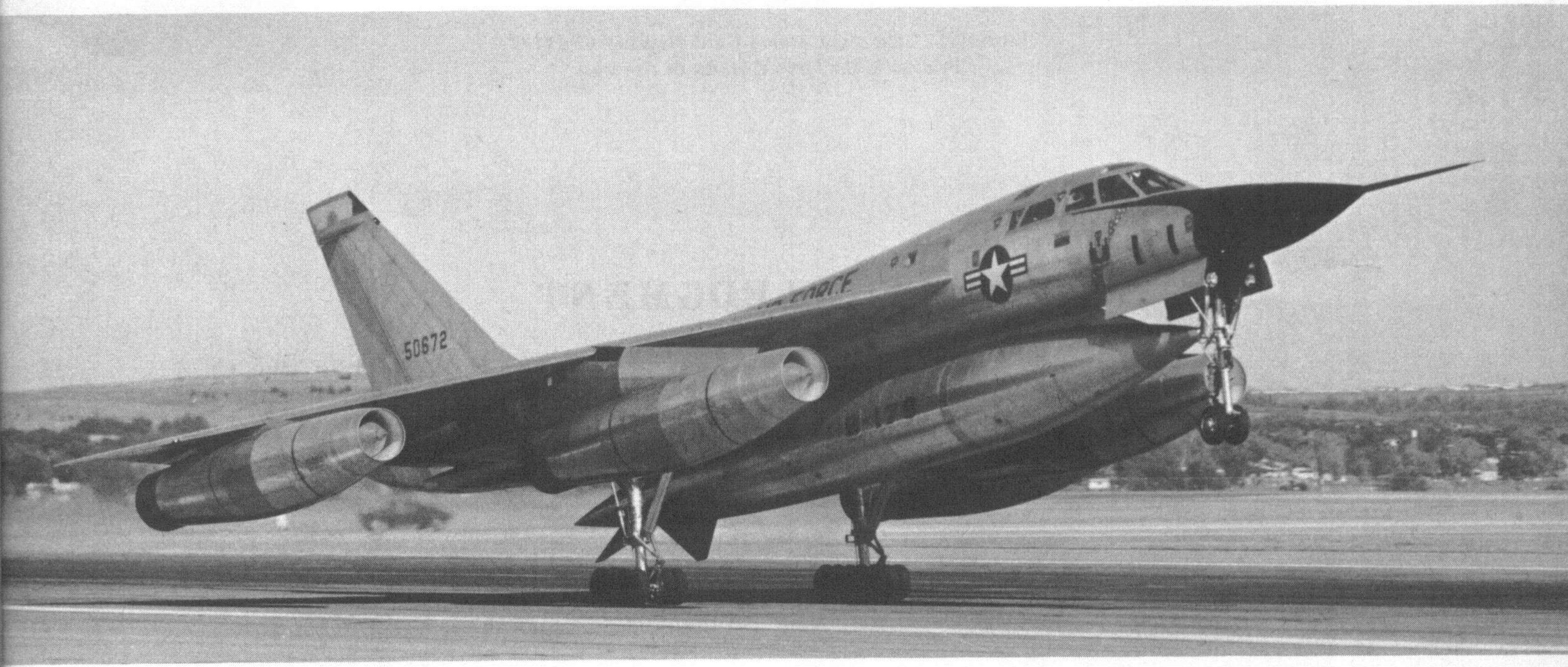

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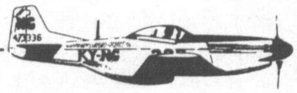
by Douglas H. Robinson

Scale drawings: Richard Groh

A Len Morgan Book



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In Dallas, Mr. T. L. Morgan for photographic coverage of the 43rd Bomb Wing.

Lastly, for his constant interest in the book, to which he has consented to contribute a foreword, General Thomas S. Power, former Commander in Chief of the Strategic Air Command.

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FOREWORD BY THE FORMER COMMANDER IN CHIEF OF THE STRATEGIC AIR COMMAND, UNITED STATES AIR FORCE

Will the fantastic B-58 Hustler be the last of a long line of bombers? Has the intercontinental ballistic missile, with its electronic brain, rendered the manned aircraft obsolete? Or does its flexibility, its reliability, the fact that it is under positive control and can assess strike damage in enemy territory give the manned bomber a significant advantage over the rocket-powered missile? Though General Thomas S. Power, as Commander of the Air Research and Development Command, played an important role in evolving our early Atlas missile, he has continued to believe that the manned bomber is indispensable to the security of the United States. As Commander in Chief of the Strategic Air Command between 1957 and 1964, he was concerned by the fact that only two wings of supersonic B-58s were available to SAC. Yet, as he writes in his book, "Design For Survival," no additional wings of B-58s were authorized despite his urgent recommendations. Nor was any new bomber design under development when he retired.

General Power has kindly agreed to write the following foreword especially for this book, in which he offers a prophecy concerning the next bomber in SAC's arsenal:

"In my opinion, the B-58 Hustler Strategic Bomber is one of the best strategic weapon systems in existence today. Its ability to fly at high altitudes at supersonic speed, as well as its ability to fly at high subsonic speeds, close to the ground, gives this aeroplane a flexibility that is particularly desirable in this day of sophisticated defenses. Even though only possessed in small numbers, the B-58 will go down in history as the vehicle that proved the worth of supersonic strategic bombardment aircraft.

"I am sure that the F-111 will benefit greatly from the experience gained by Convair in developing and building the B-58 and I hope that the F-111 will be introduced into the Strategic Air Command inventory at the earliest possible date."

Thomas S Power

General Thomas S. Power, USAF (Ret.)

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[1] Thomas S. Power, *Design For Survival* (New York: Coward-McCann, Inc., 1965).

"Firefly," Major Deutschendorf's record breaker.

The Professional's Airplane

Thunder reverberates under a cloudless sky, and heads turn toward the source, at the end of the runway nearly two miles away. There a speck, trailing a plume of black smoke, is slowly gathering speed. Quickly it grows in size, accelerates, faster and faster, to 100, to 150 knots. The shape becomes clearer — sharp needle nose, slim body, tall tail, landing gear like insect legs, narrow, fin-like wings, roaring jets slung in shining, rounded pods beneath. Smoothly the aircraft rears back on its wheels, to an incredible fourteen degrees, showing from underneath a dart-shaped, pointed wing like that of a giant ray. Seemingly without effort, for all its eighty tons' takeoff weight, it leaps upward and in a moment, with gear retracted, sweeps heavenward and out of sight, the earth-shaking roar of its afterburners echoing from the surrounding hills.

This is the incredible B-58 Hustler, five years in its country's service and already historic in its own lifetime. The first large supersonic aircraft, the first (and thus far only) supersonic bomber in regular service in the Free World, the first bomber to hold a multiplicity of speed records usually reserved to fighters, and representing dramatic technological breakthroughs in design, structure, power plant, control, bombing/navigational and electronic systems, the Hustler will be remembered as a milestone in the evolution of aeronautics.

Together with the B-47 Stratojet, the B-52 Stratofortress, and the new intercontinental Minuteman and Titan II missiles, it constitutes the mailed fist of the Strategic Air Command, clenched ready to defend the Free World in the thermonuclear age.

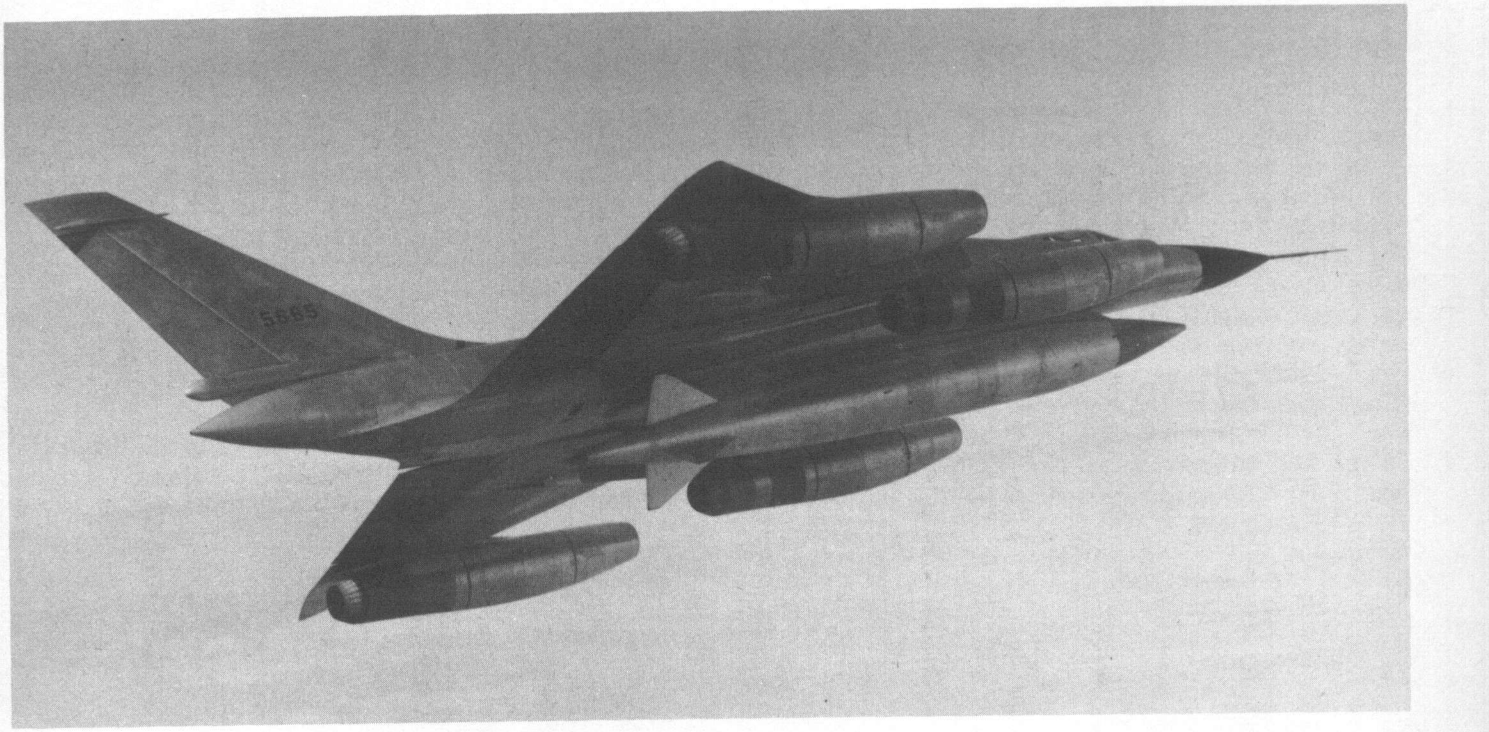
To the present-day Air Force, which lives by the computer, the shapely, delta-winged Hustler is a "weapon system." To the men who fly it, it is a "bird." To those who regard the intercontinental ballistic missile as an "interim weapon," the Hustler is a romantic antique. To me it remains an airplane in the tradition of the winged vehicles which have conquered the skies in my lifetime — breathing air, borne aloft by the air, and directed and controlled by mortals both skillful and courageous. The Hustler, with its technical sophistication and fantastic speed, demands the utmost from its servants, and the three men who fly it — pilot, bombardier/navigator, and defense systems operator — are dedicated professionals. So critical are the margins in operating a craft with a gross takeoff weight of 163,000 pounds — heavier than a World War II B-29 Superfortress — and a wing loading of 105 pounds per square foot — that everything must be done "by the book." Working from a flight plan drawn up in advance, the crew are busy every second on journeys that compress the breadth of continents into a few brief hours.

So I found when I sat in with a Hustler crew of the 43rd Bombardment Wing who were planning a radar bombing mission ("Spot Remover") for the next day. There was an unusual challenge in the directive, to test the ability of the supersonic monster to make evasive turns at a 60-degree angle of bank while flying at a speed of Mach 2 at 44,000 feet. Tables and graphs were brought out to determine the G load and turning radius that might be expected. "I don't know just how it will go," related Lieut. Col. Charles L. Simmons Jr., the pilot. "If the nose drops and it begins to get away from me, the speed will build up fast in a dive."

Controlling the aircraft would be too critical to waste time admiring the view. "I hardly ever look out when I'm up there," continued Colonel Simmons. "After all, there isn't much to look at. I lower my seat as far down as it will go and concentrate on my instruments." Major Earl N. Nedrow, the defense systems operator in the rear, assisting the pilot by reading his check lists, monitoring the location of the center of gravity on which stability depends, is too busy to consider the view. Lieut. Col. John M. Weeks Jr., the bombardier/navigator, cannot even see out his tiny windows, as he has buttoned curtains over them, the better to see the landmarks below in his radar scope. Though he plunges blindly through the skies at 1300 miles per hour, in touch with his enviroment only through his instruments, not his senses, it was Colonel Weeks who smilingly insisted, "please tell them that we like our work." He meant the pride and satisfaction of accomplishment, of operating the newest and finest equipment — the only large supersonic aircraft outside of Russia — and the distinction of belonging to an elite formation in which his countrymen reposed special trust and confidence. I was not surprised when I saw those men listed among the five "crews of the month" on a notice board outside Wing headquarters.

Experience counts for more than youth in handling the Hustler. The lieutenant colonels and majors to whom these aircraft are entrusted are not the beardless youngsters who held those ranks in World War II. Colonel Simmons admitted to being 43 years old, Colonel Weeks was 47, Major Nedrow, who pretended a filial concern for the "old men" up front, was a stripling of only 32 summers. Yet their ages meant years of familiarity with earlier bombardment aircraft — the B-47 Stratojet, the B-29 Superfortress, even the B-17 Flying Fortress of World War II. All this stood them in good stead when they came to fly the B-58, yet they meet the challenge of the supersonic bomber with the buoyant enthusiasm of youth.

Hustler flight crews are aware that the name has more than one meaning. But they feel respect, as well as affection, for this incredible performer in their charge — "the bomber that flies like a fighter."



"Why Does It Look Like That?"

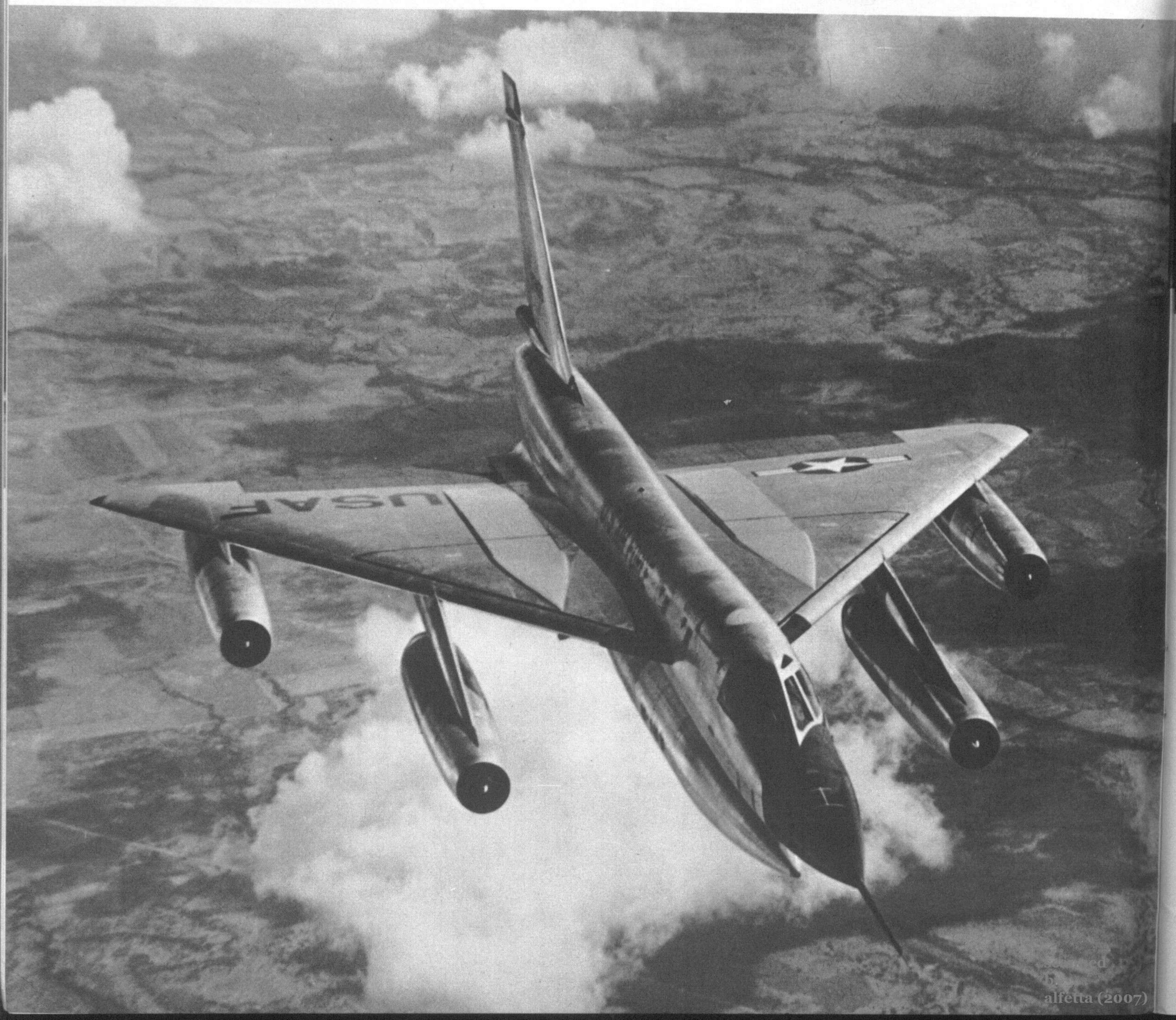
An overgrown paper dart? A rocket with wings? A monster nine months pregnant? Anything but an airplane, the average flier might think, on first sight of the Hustler. With its long, slender body, sharply pointed at the nose and constricted amidships; with its triangular wing, longer than it is wide; with the capacious weapons pod and four jet engines hung beneath the wing on pylons, and 9-foot landing gear legs holding it bird-like off the ground, the B-58 is actually a shape suited for its purpose, every flowing line sculptured for a reason, the symbol and the expression of supersonic aerodynamics. Even on the ground it seems to be eager to be hustling places.

Nothing remains, however, of the conventional subsonic aircraft with which we are all more or less familiar. My own Piper is the end result of over forty years of research in aerodynamics. With a flat-four piston engine in the nose turning a wooden propeller, a fabric-covered fuselage more or less streamlined and intended to house me and a passenger, with its fixed horizontal and vertical tail with hinged control surfaces attached, and its straight, thick-section, high lift wing, it offers no surprises at stalling speeds and is safe, docile and reliable so long as I do not exceed a red-line speed of 120 m.p.h. For years piston-engined aircraft were built to the same formula, which assumed that air was incompressible and treated it as such.

This was not true, and with higher air speeds the fact could not be ignored. With the development in the late 1930s of clean all-metal monoplanes with retractable landing gear and piston engines exceeding 1000 h.p., unexpected control and vibration problems began to appear at high speeds, particularly in dives. These were attributed to "compressibility," and indeed, the compression of the air ahead of the wings and tail, and where it was constricted and accelerated in its path around the fuselage, played

a part in the problem. Sometimes the offending aircraft became nose-heavy in dives, or even more disconcerting to the pilot, the controls locked or proved ineffective. Severe vibrations in the tail, or in the entire airplane, might tear it to pieces. The speed of the aircraft in relation to the speed of sound was recognized as a significant determinant of such abnormal behavior, the phenomena appearing as the aircraft approached the speed of sound — 760 m.p.h. at sea level, less at higher altitudes. Designers began to speak of the Mach number, the figure expressing velocity at any height relative to the speed of sound. Thus, Mach 1 would equal 760 m.p.h. at sea level, but might be lower at greater altitudes. With further research it was determined that even though the entire aircraft might be flying at less than Mach 1, the air at certain points, particularly the leading edges of wings and tail, could be accelerated to supersonic speeds, with the formation of shock waves. These were constant disturbances streaming back from the aircraft at an angle determined by its speed, and caused by the inability of the air, compressed ahead of the fast-flying plane, to get out of the way. Shock waves absorbed a great deal of energy and enormously increased the drag, and at first it was thought this would prevent any aircraft from "going through the sound barrier," or exceeding about Mach 0.8. In addition, the shock wave at the leading edge of the tail could blanket the elevators, so that they operated ineffectively in stagnant air. As the shock wave moved aft at still higher speeds, it might "freeze" the elevator, or even cause it to move by itself. The shock wave on the leading edge of the wing completely changed

A coke bottle . . .



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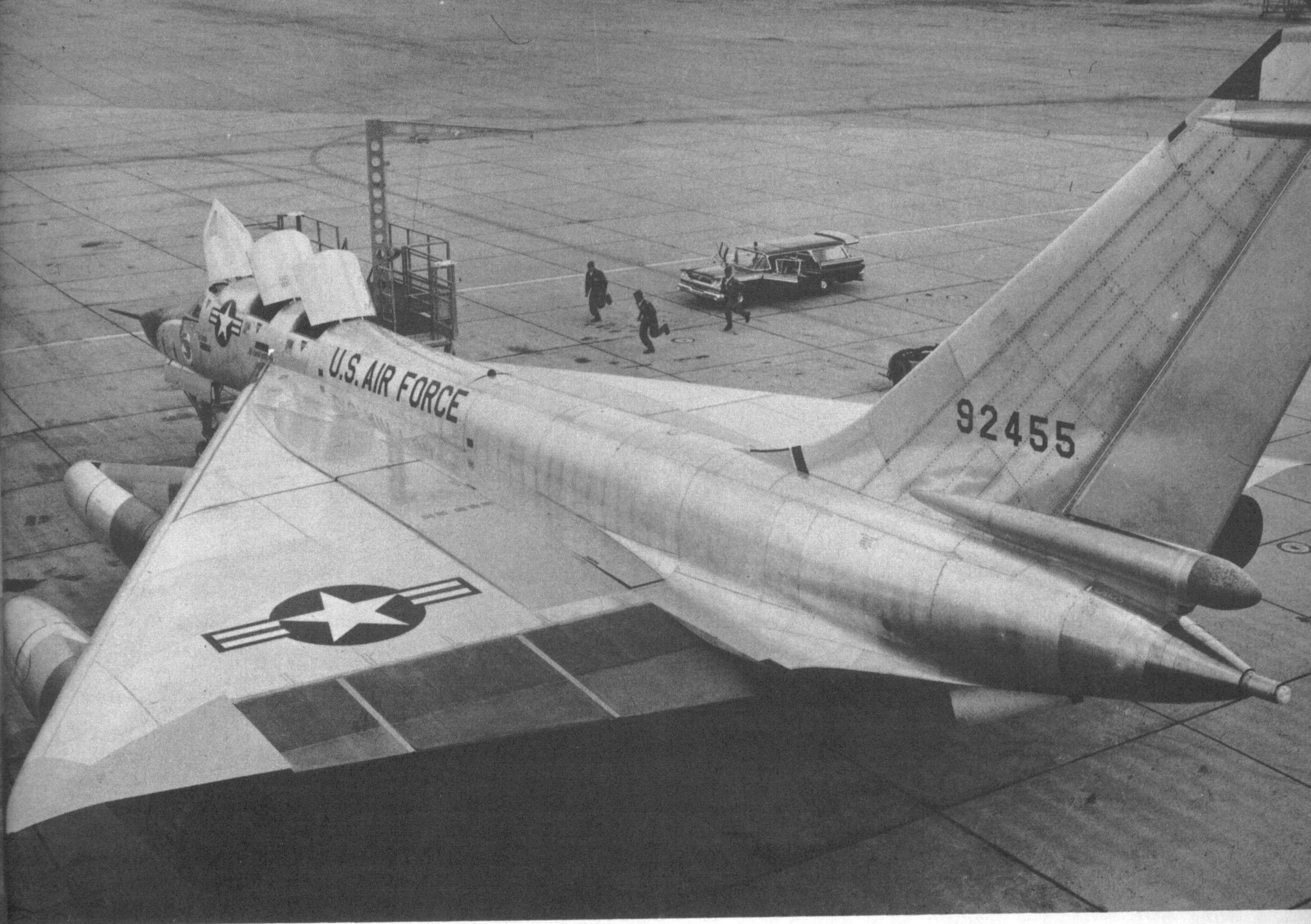

with sixty degrees of sweep.

its lift characteristics; in fact, with the customary thick wing used then with blunt leading edge and cambered upper surface, the lift forces reversed themselves at supersonic speed, the force on the wing become downward instead of upward, with the result that the plunging aircraft finally achieved equilibrium in an inverted dive — with no hope of recovery because the elevators were useless.

Thus, the conventional-shaped aircraft, even the early jets such as the Lockheed F-80, could not be driven beyond a speed of about Mach 0.8 because of the enormous drag of the shock waves building up at this velocity, and furthermore, because at this speed they became uncontrollable. Changes were in order if faster aircraft, particularly jet-propelled, were to go through the "sound barrier" beyond Mach 1 and also be controllable. The first advance was in airfoil design. The reversal of lift forces on the conventional thick cambered wing suggested a thin, biconvex surface with sharp leading and trailing edges, piling up less air ahead of it in the leading edge shock wave, and developing lift at both subsonic and supersonic speeds. A straight, thin-section wing lifted the experimental rocket-powered Bell X-1, which was first through the "sound barrier" in level flight on October 14, 1947, and reached Mach 1.04. But the straight wing, with a shock wave along its entire span, carried an enormous mass of air along with it.

One theoretical way of reducing shock-wave drag, which might appeal to antique airplane enthusiasts, is the "Busemann biplane," in which, at a particular supersonic velocity, the shock waves from two specially-shaped wings are reflected off each other internally and turned parallel to the air flow, with no external wave disturbance. Unfortunately for the linen - strut - and - wire fraternity, this solution has found no acceptance in practice. The other and more practical answer is the swept-back wing. While its center generates shock waves, the outer portions, traveling inside the Mach wave cone, are in effect working in subsonic air, with much less shock drag than with the straight wing at supersonic speed. A refinement of the swept-back wing is the delta wing, triangular in plan form.[2] Not only does the delta's swept-back leading edge have the shock stall-avoid-

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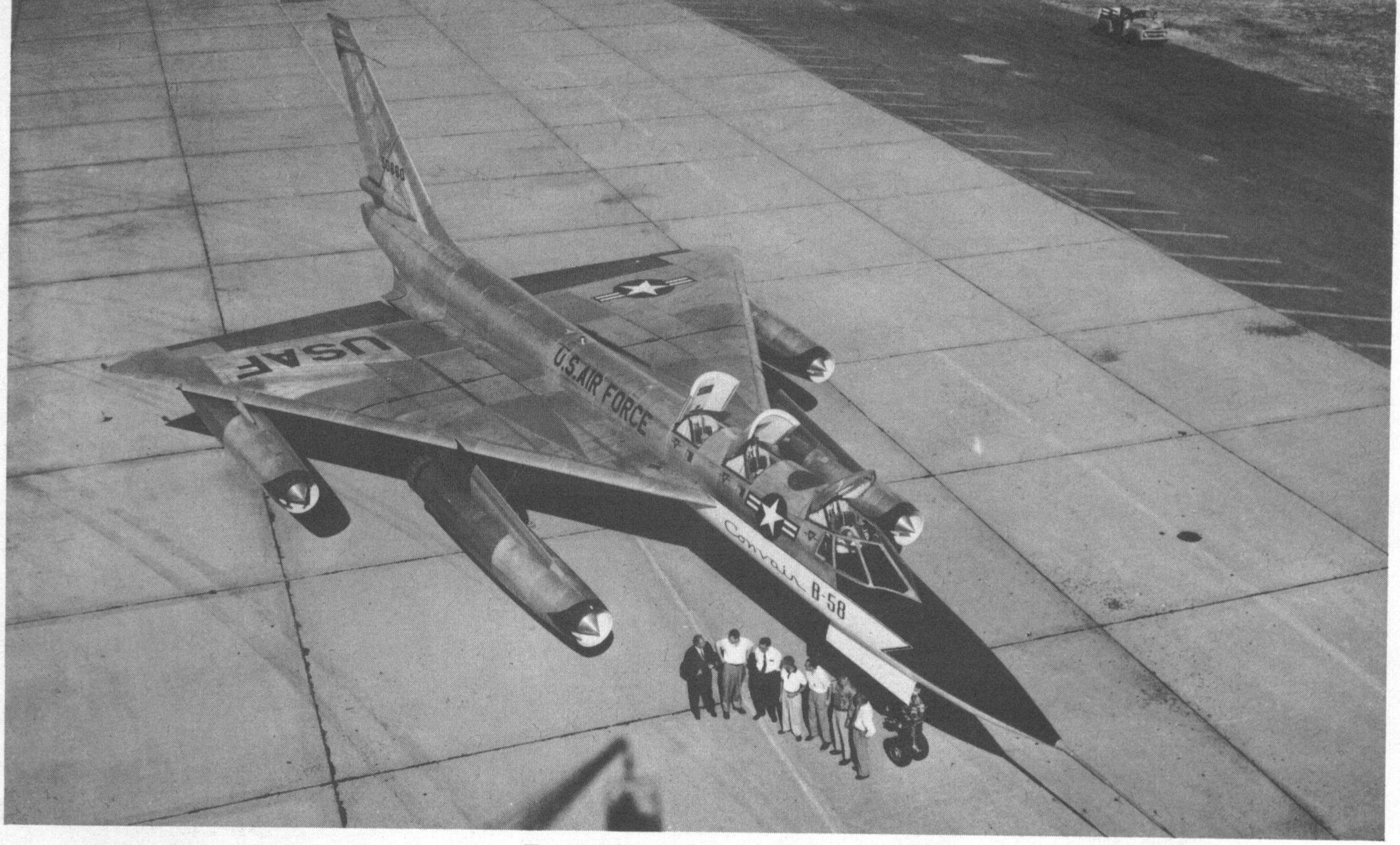
[2] The delta wing concept owes much to the researches of the German designer Dr. Alexander Lippisch. Beginning with all-wing gliders in 1927, he designed a series of delta-wing gliders in the early '30s. Ultimately Lippisch was responsible for the swept-back wing design of the revolutionary Me. 163 rocket-powered fighter which achieved a record speed of 622.7 m.p.h. in December, 1941, and was used operationally by the *Luftwaffe* in World War II. Lippisch was brought to this country in 1946, and to a limited extent acted as a consultant to Convair-San Diego in designing our first delta-wing fighter, the XF-92A.



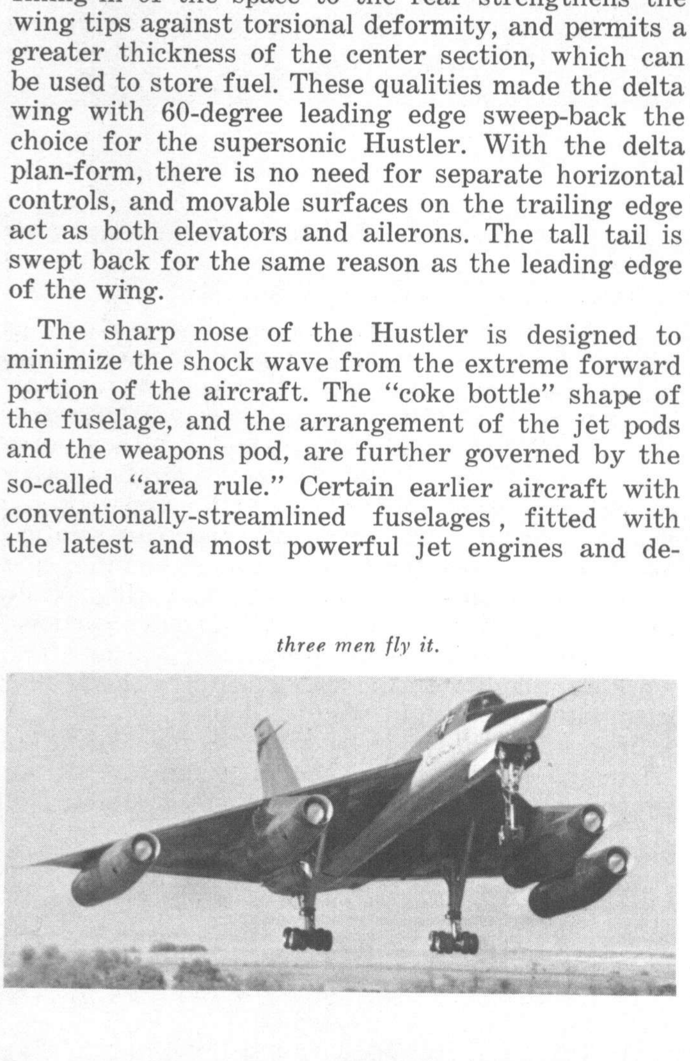
Twenty thousand men built it

ing qualities of the swept-back surface, but the filling-in of the space to the rear strengthens the wing tips against torsional deformity, and permits a greater thickness of the center section, which can be used to store fuel. These qualities made the delta wing with 60-degree leading edge sweep-back the choice for the supersonic Hustler. With the delta plan-form, there is no need for separate horizontal controls, and movable surfaces on the trailing edge act as both elevators and ailerons. The tall tail is swept back for the same reason as the leading edge of the wing.

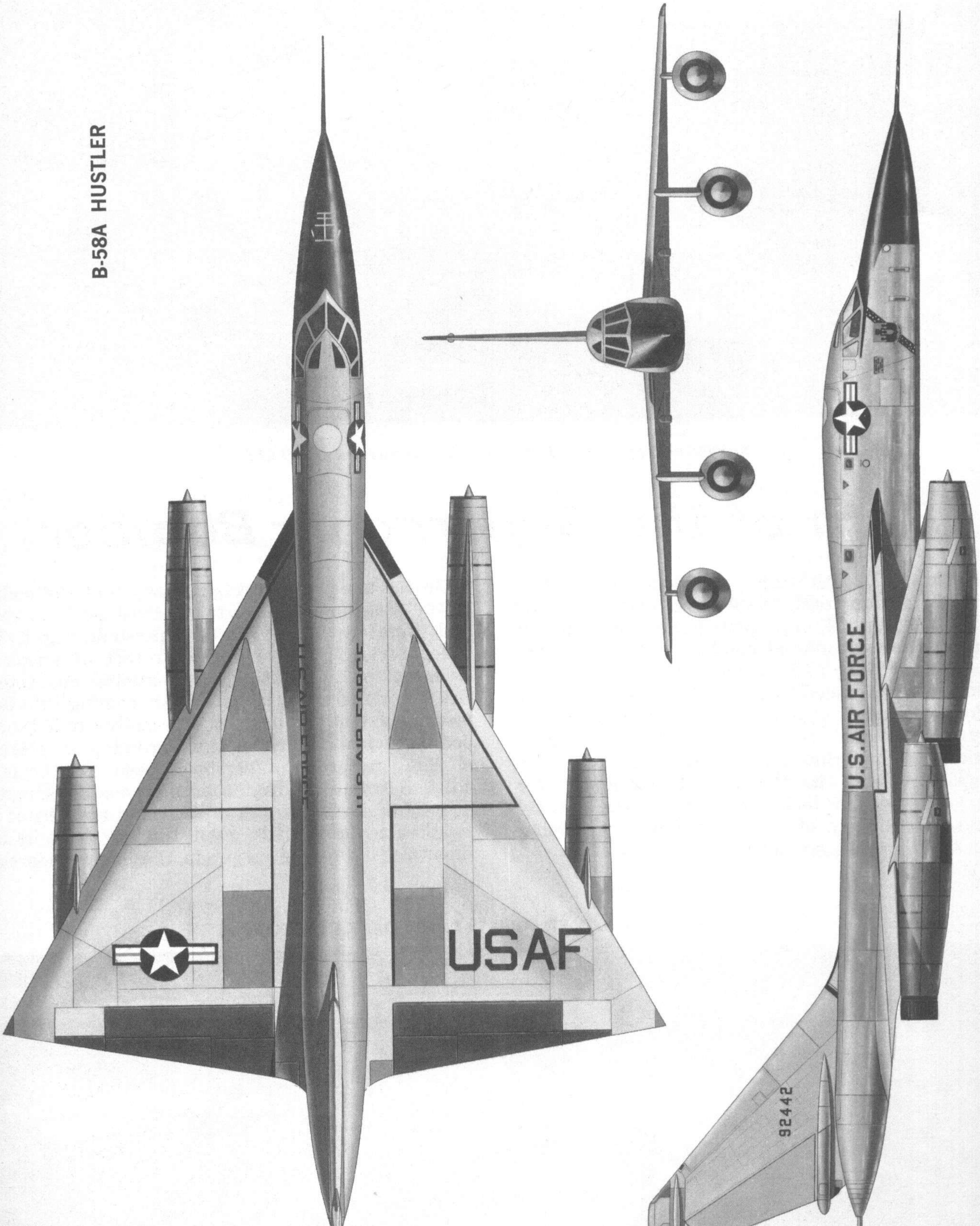
The sharp nose of the Hustler is designed to minimize the shock wave from the extreme forward portion of the aircraft. The "coke bottle" shape of the fuselage, and the arrangement of the jet pods and the weapons pod, are further governed by the so-called "area rule." Certain earlier aircraft with conventionally-streamlined fuselages, fitted with the latest and most powerful jet engines and designed to exceed the speed of sound, had in fact failed to surpass Mach 0.9. Studies by the NACA showed that a massive shock wave developed at the point where the wing attached to the fuselage, due to the sudden increase in the cross-sectional area of the wing/fuselage combination at this point. On the other hand, if the cross-sectional area of the entire aircraft were kept constant, or smoothly varied by small amounts at succeeding stations from nose to tail, the massive shock wave whose drag prevented passing the "sound barrier" did not develop. A corollary of the "area rule" was that where the wings attached to the fuselage, the cross sectional area of the latter should be reduced, while the diameter of the fuselage might actually be increased before and behind the wing. The Hustler has such a fuselage. Furthermore, the "area rule" is responsible for the inboard jet engines being mounted well ahead of the wing on long, swept-forward pylons, so that their afterburner nozzles barely overlap the intakes of the outboard nacelles. (In the inlet of the jet engines is a translating central spike which at supersonic speeds advances to keep the shock waves clear of the circular intake). The weapon pod, too, with its sharp nose, slim tail and greatest diameter well forward of the wing is included in the "area rule."

There is an old adage in the flying game, "if you mounted a big enough engine on a barn door, it would fly." But even with four General Electric J-79 turbojets, producing a total thrust of 62,400 pounds with afterburner, the barn door would not attain Mach 2. Brute power is not the complete answer, and the Hustler is a supersonic success largely due to refinements in design.

three men fly it.



B-58A HUSTLER



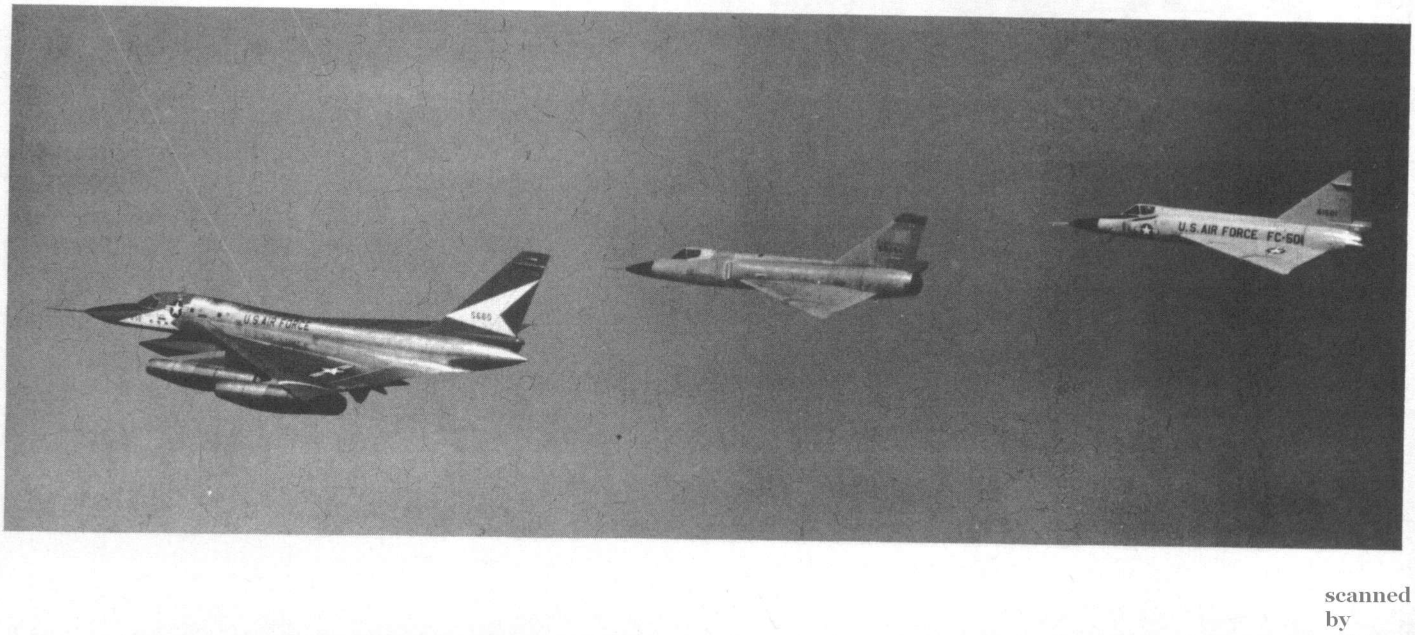
Groundmen ignore aging B-36 and B-50 to admire new HUSTLER.

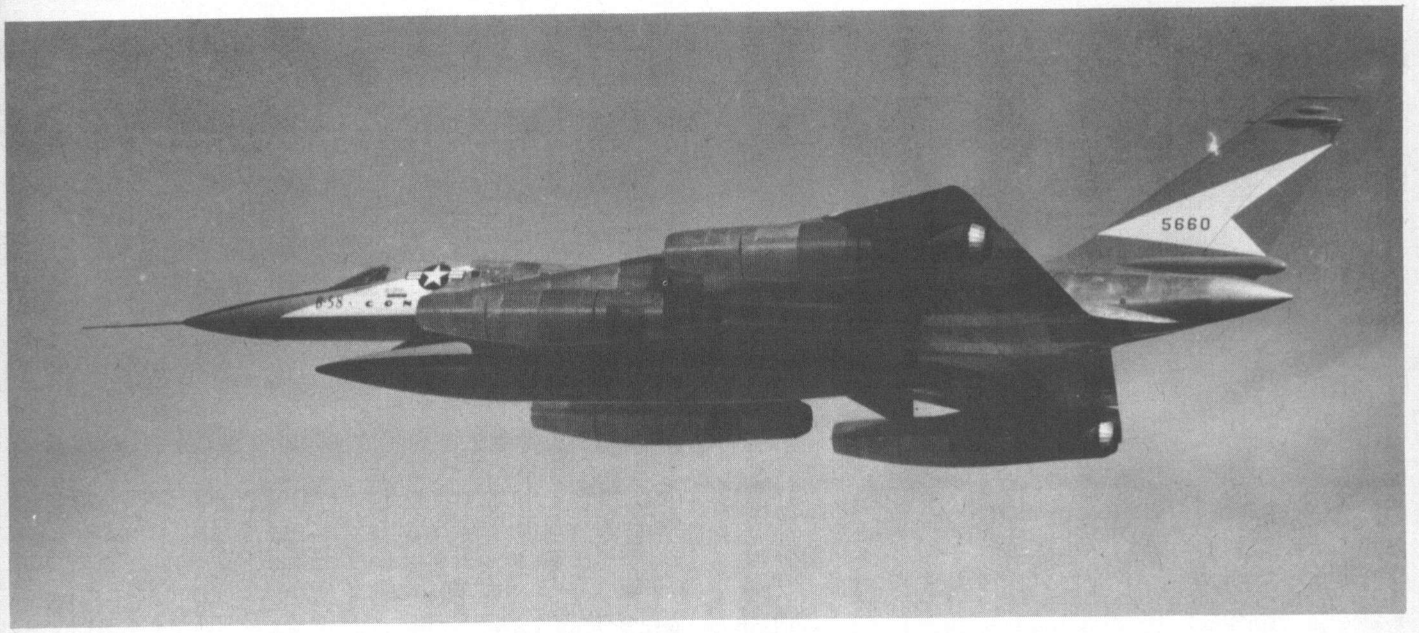
Birth of the Supersonic Bomber

The Boeing B-47 Stratojet, and its bigger brother, the B-52 Stratofortress, developed in the early years after World War II, represented the application of jet power to conventional bombing concepts of the day. Still traveling at subsonic speeds, the two big Boeings were intended to penetrate enemy air space at great altitudes, and were originally designed to carry conventional bombs. The supersonic B-58 Hustler, on the other hand, derived from a new concept developed in the late 1940s and early 1950s — one which took into account the greatly increased capability of ground defenses, including radar tracking and ground-to-air missiles.

On the one hand, it was realized that the bomber of the future must have the highest possible speed, and therefore be capable of supersonic flight. This called for a relatively small aircraft of unconventional shape and with unconventional characteristics, the delta wing, in particular, coming into early prominence. A droppable, externally-carried bomb pod was visualized from the beginning as a means of bomb release at supersonic speed. On the other hand, it was clear that the enormous consumption of jet fuel at supersonic speed would not permit the small attack aircraft to go all the way from its continental base to the target in the enemy heartland

Convair deltas: HUSTLER; DELTA DART; DELTA DAGGER.



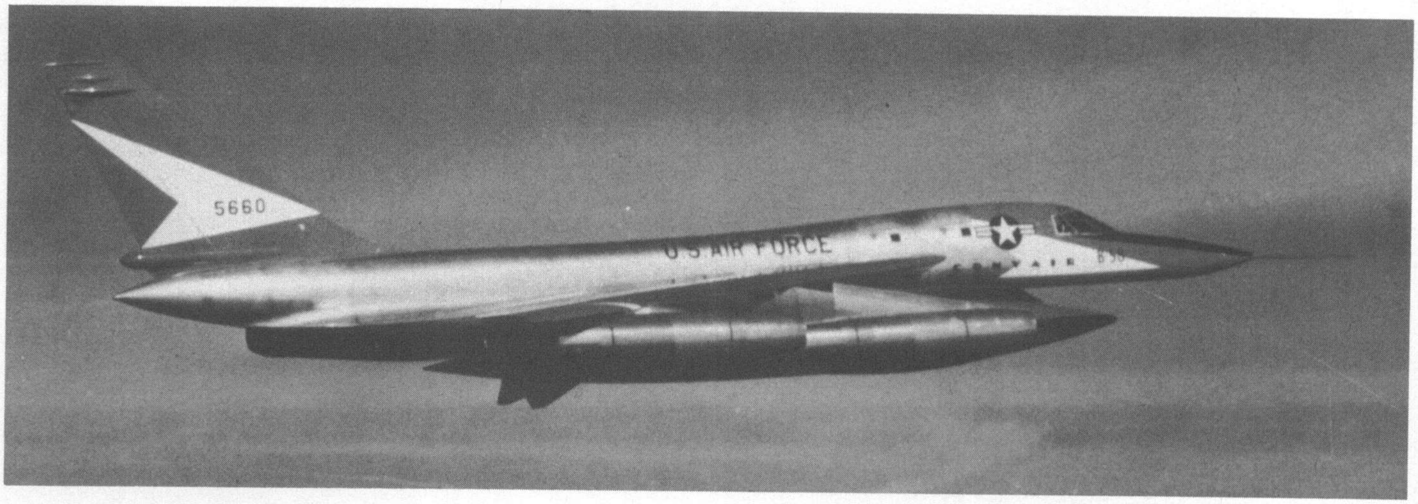


Five Six Six Zero, the first B-58 delivered by Convair, tries her wings.

at such velocity. The bomber was, therefore, to be carried as a parasite under a large, slow transport aircraft. For the composite weapon, the journey was divided into three zones: the "logistics" zone at the start, during which the parasite would be attached to the parent transport; the "combat" zone near the enemy's border where the parasite would be released; and the "target" zone, into which the short-range bomber would penetrate at supersonic speed, to bomb and return to the parent aircraft. Low-altitude penetration under the enemy radar was considered, as well as high altitude flight.

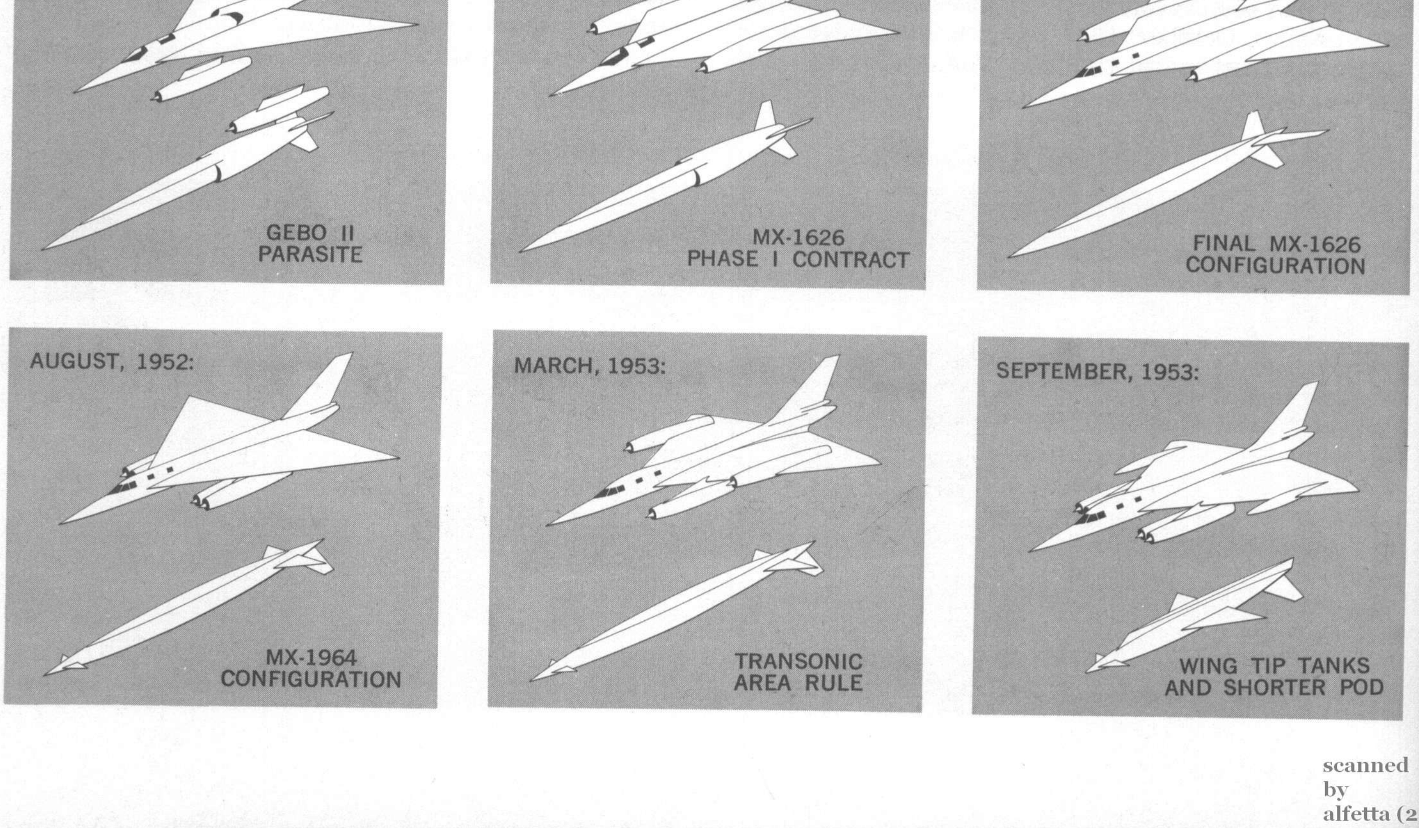
The Convair firm of Fort Worth, Texas — to be merged in 1954 with the General Dynamics Corporation — had been involved in advanced bomber design studies since October, 1946, when it had undertaken under contract with the Air Force a theoretical study of the long range subsonic bomber of the future, known as GEBO (GEneralized BOmber) I. Approximately 10,000 configurations on paper were studied and compared, with respect to speed, range, and gross weight, and involving different combinations of wing area, aspect ratio, sweep back, turboprop and pure jet propulsion. Ultimately this study led to an Air Force requirement for a medium bomber with a gross weight of 200,000 lb., a radius of 2000 miles, and a 10,000-lb. bomb load. Boeing received a Phase I contract in 1948 under this requirement for their XB-55 with four jet engines and four turboprops, but the program was cancelled early in 1949 with the realization that this subsonic design would not have penetration capability against modern ground-to-air defenses.

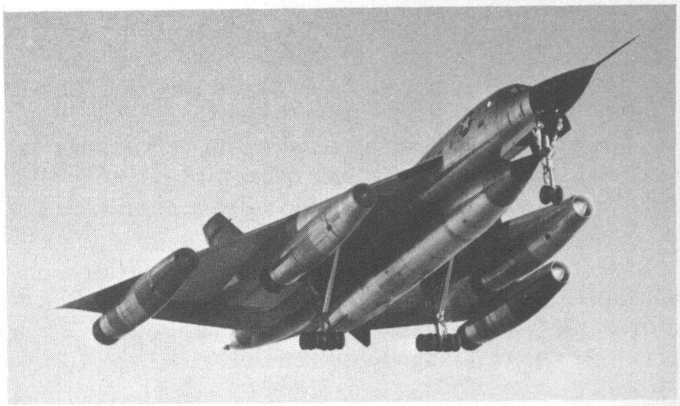
On June 6, 1949, Convair received from the Air



Force a contract to continue generalized bomber studies under the designation of GEBO II. Initially, they were called on to attempt to settle the turboprop vs. turbojet power plant controversy, and to apply the solution to a bomber with a radius of 1200 to 2500 nautical miles with a 10,000 lb. bomb load, cruising speed of over 450 knots, and flight altitude above 35,000 feet. In April, 1950, the GEBO II requirement was changed for a system able to attack targets 3000 to 4500 nautical miles distant at speeds of Mach 0.9 to 1.5. Convair had already proposed in January, 1950, a small delta-wing composite carrying 2 men, which would be transported into the target zone by a B-36. With one engine in the tail, two droppable jet engines under the wings, and one in the tail of the long, finned bomb pod (all without afterburners) the parasite would have a launch weight of 100,000 pounds, would cruise to the target at Mach 1.3 (increasing to Mach 1.6 over the target), and reach a maximum altitude of 48,500 feet before pod release. After the attack the "return component" would fly back to the B-36 with its single engine at Mach 0.9. A modification in the fall of 1950

B-58 DESIGN CONFIGURATIONS, 1950-1953

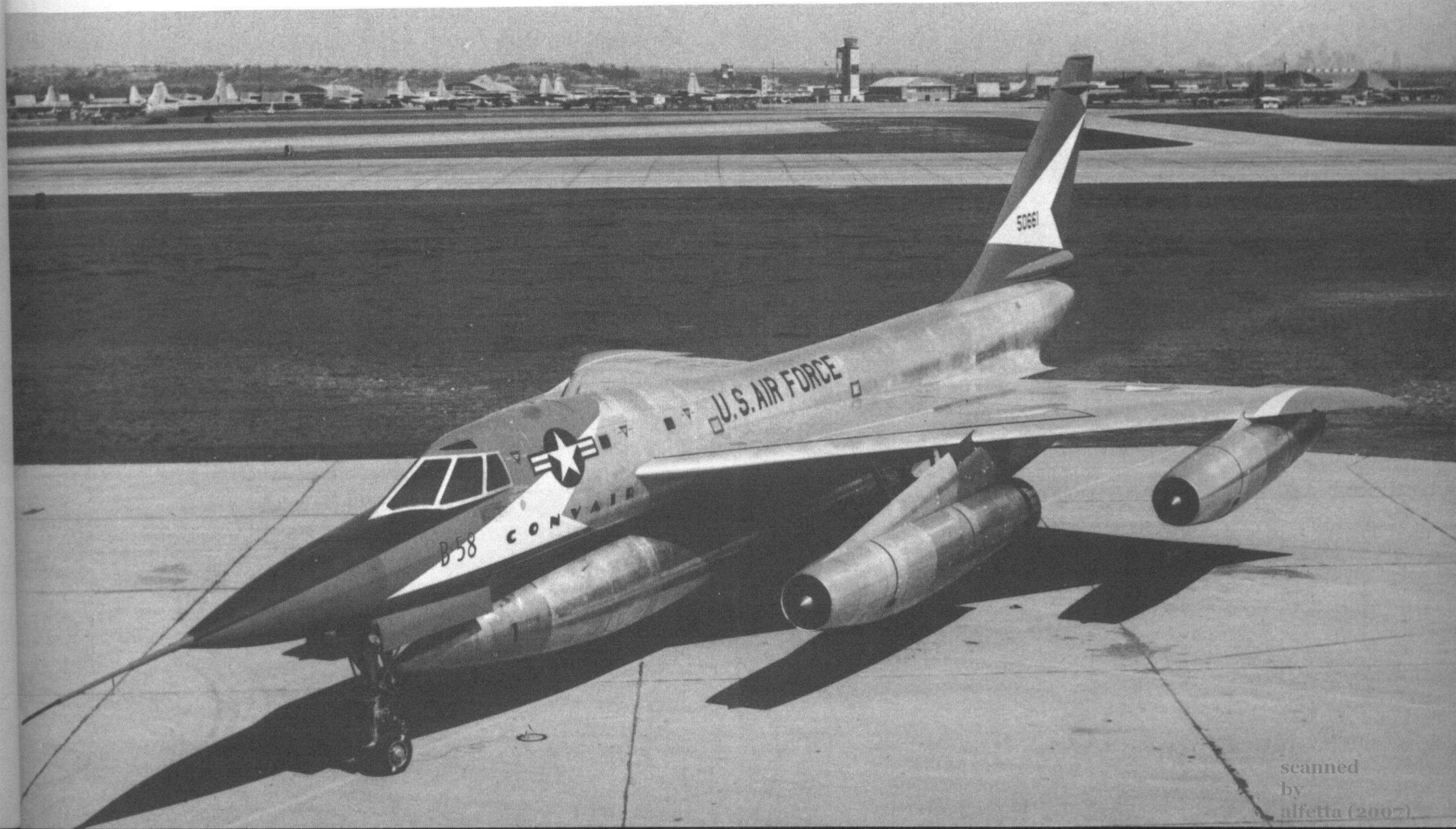




involved two fixed jet engines buried in the wings, two droppable engines under the wings, and a fifth in the long, streamlined pod, plus an advanced bombing/navigational system and passive electronic countermeasures system but no active defense. Originally the pod was intended to carry conventional explosives, but early in the GEBO II program a thermonuclear warhead was incorporated. The long, finned and streamlined bomb with a jet engine in its tail could function as a free-fall bomb; with small wings as a powered glide bomb or an air-launched missile, and as late as 1953 it was expected that the pod, with propellant system and fins, would have a range of 100 nautical miles.

Though Boeing's large jet and turboprop XB-55 had been cancelled, the Seattle firm was working on a four-jet shoulder wing bomber, their Project MX-1022, with 47-degree sweep-back of the leading edge, a tail reminiscent of that of the B-47, and a three-man crew. (Later this was to be referred to as the XB-59). Radius was 2,280 nautical miles at Mach 0.9, or 1,737 nautical miles at Mach 0.9 plus 185 nautical miles at Mach 1.3. The Air Force budget for fiscal 1951 and 1952 supported both the Boeing design and the Convair GEBO II delta parasite, and in February, 1951, both firms received Phase I contracts. The Convair MX-1626 proposal was for a small delta wing bomber to be carried as a parasite under a turboprop powered B-60, the swept-back variation of the B-36. It would now have only three non-afterburning engines, two fixed ones in wing nacelles and one in the pod, a gross weight of 107,000 lb., a two-man crew, and a minimum landing gear to carry the weight of the "return component" only.

During the Phase I studies of the MX-1626 proposal the parasite approach was dropped in favor of in-flight refueling using the early probe-and-drogue method just then coming into service. The expendable engine principle was also discarded, and the MX-1626 design which emerged in December, 1951 was for a small delta with two fixed engines in nacelles in the wings — for the first time with afterburners — and a long slender bomb pod, its nose extending forward beyond that of the aircraft and containing search radar gear, its tail garnished with three long swept-back fins, and its upper



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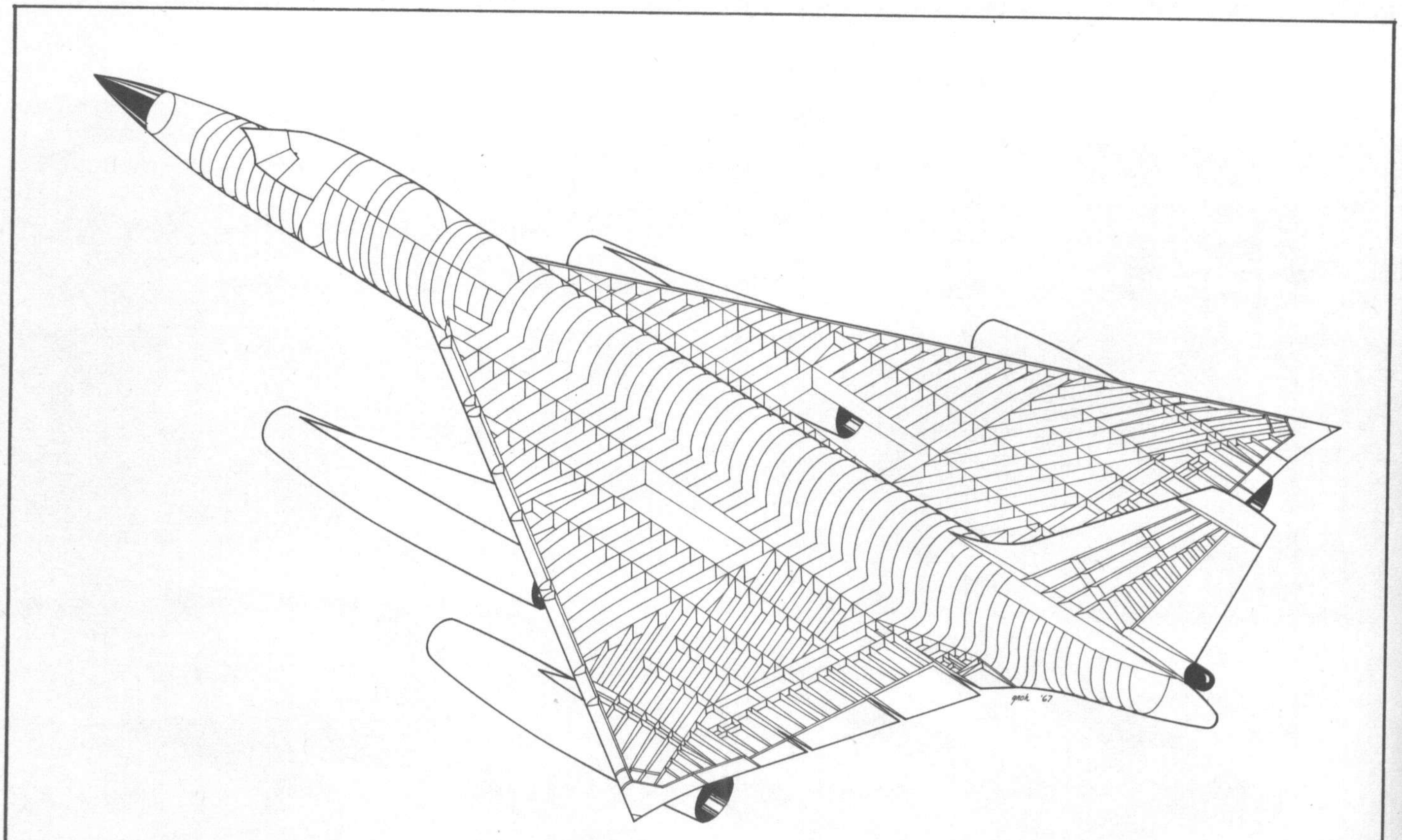
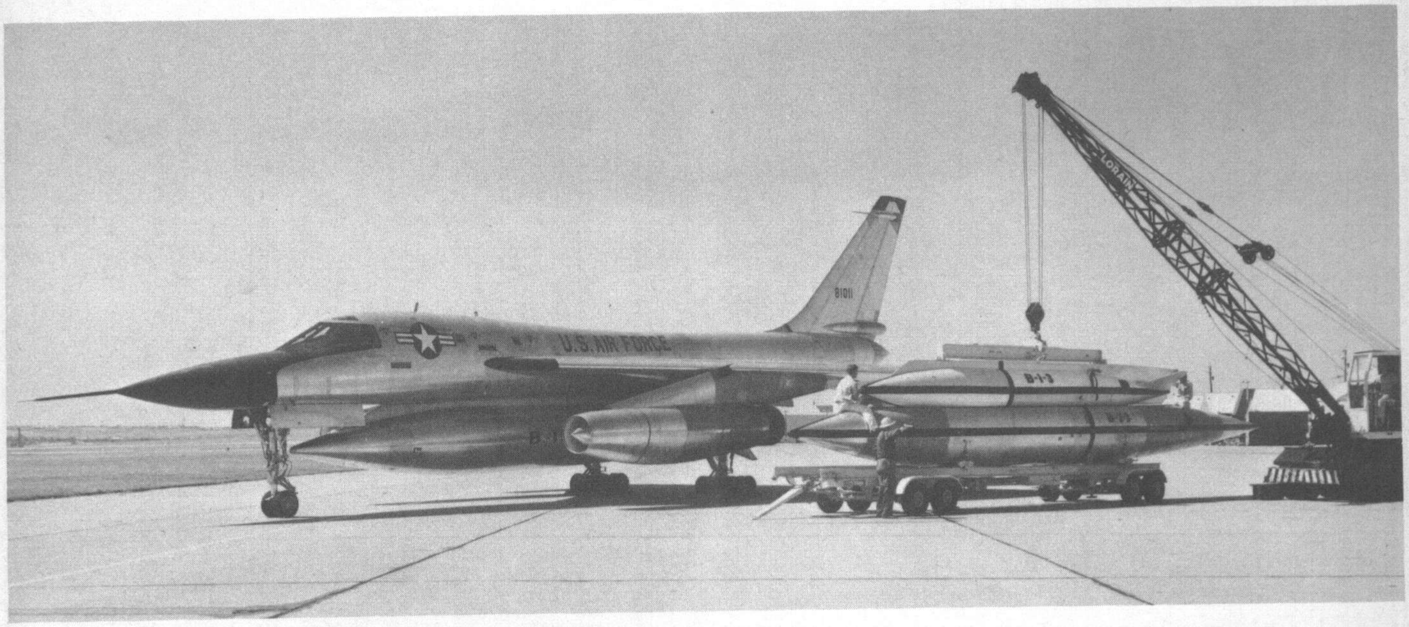
surface fayed flush to the lower portion of the fuselage. With a crew of three, this craft had a radius of 2300 nautical miles from advance bases, or 4000 nautical miles in intercontinental operations, with a single out-bound refueling at a distance no greater than 2500 nautical miles; the bomb pod, functioning as an air-to-ground missile, had a range of 50 nautical miles.

The progress of the two supersonic designs encouraged Headquarters USAF Directorate of Requirements to publish on December 8, 1951, a General Operational Requirement (GOR) for a strategic bombardment system (SAB-51) with a minimal operational radius using the single refueling concept of 2000 nautical miles, a 2300 nautical mile radius at 50,000 feet, low altitude capability at high subsonic speed, and maximal supersonic dash capability. A strategic reconnaissance system (SAR-51) of February 1, 1952, sketched a similar aircraft for reconnaissance purposes. Both Boeing and Convair competed for a contract under the two GORs, the Convair contender, designated the MX-1964, resembling the MX-1626, but having four jet engines with afterburners in paired pods in each wing, takeoff gross weight increased to 140,000 lb., the wing area increased to 1400 square feet, with leading-edge sweepback of the delta wing decreased to 60 degrees. A tail turret with machine cannon was added. Boeing continued work on their design, now the MX-1965, reducing the weight from 200,000 to 180,000 lb., but when both detail Phase I designs were presented to Air Research and Development Command on October 9, 1952, the larger Boeing design was rejected as being less capable of achieving the specified supersonic performance. The Convair design was held to provide the most promising means of achieving supersonic capability with minimum size, thanks to the Convair engineering staff's insistence on producing a "high density" aircraft. In addition, Convair was 4 to 6 months ahead of Boeing in detail design. Convair thus received a full scale Phase I development contract under the Weapon System concept, using the MX-1964 design as a basis, with the further instruction that the aircraft would be known as the B-58. At this time the Convair design staff was using the name "Hustler" within the family to designate the MX-1964; to the regret of some, the name stuck, and even became official.

The rest was refinement and detail. In March, 1953, the after fuselage was fined down under the transonic "area rule" and the four engines were distributed in four separate, staggered pods. The leading edge of the wing was cambered and twisted to minimize loss of efficiency at the tips. A small 10-degree trailing edge angle was added to the

B-58 structural arrangement.





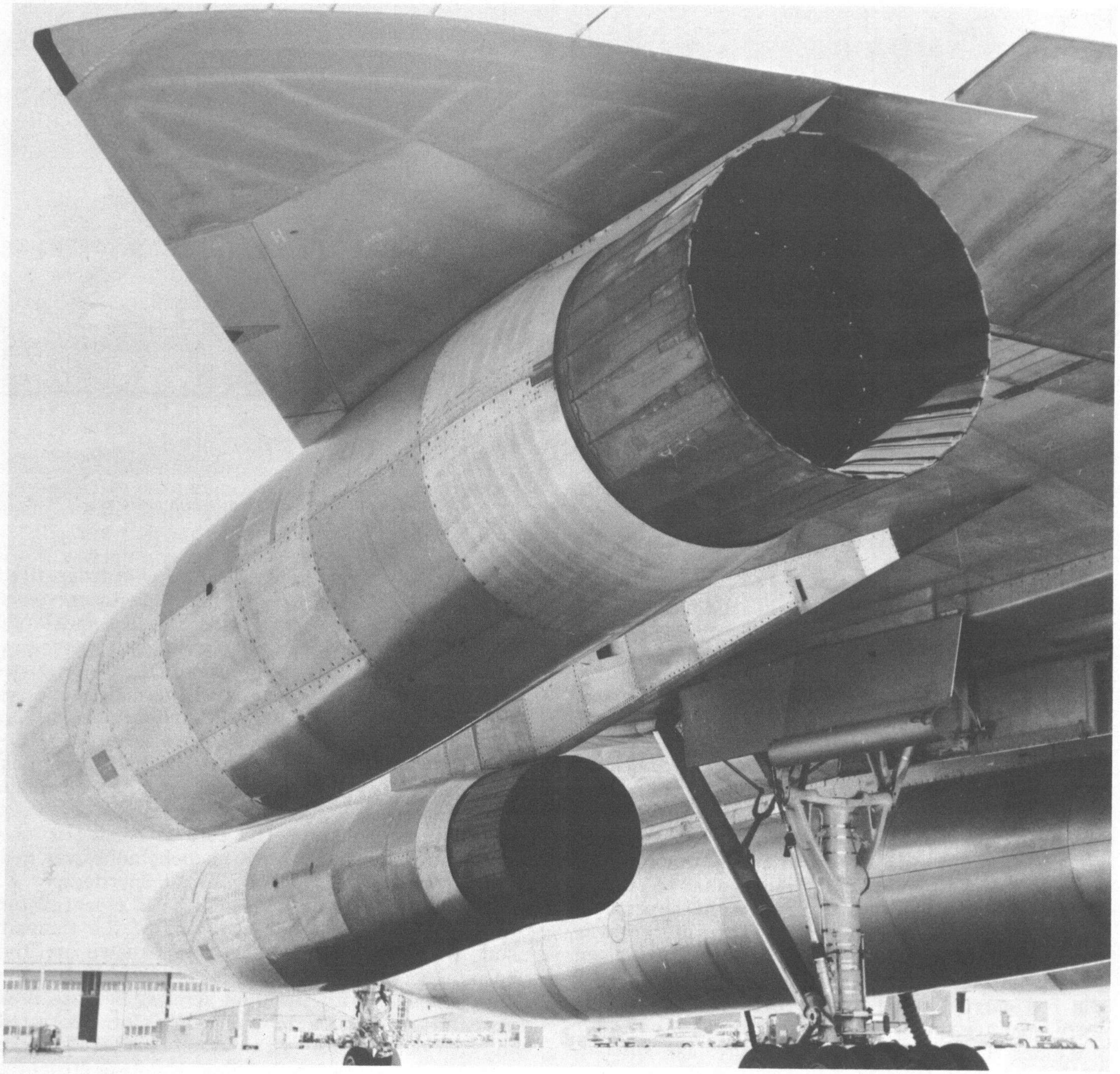
Pod on B-58 contains fuel and warhead. Alternate pod on trailer is TC (two component) with top section containing fuel and warhead, lower section carrying fuel only.

wing, increasing the area to 1542 square feet, and the takeoff weight increased to 150,000 lb. In September, 1953, the four jet engines were again in twin pods hung on pylons under the wings, with added fuel for intercontinental flight in wing tip tanks. The search radar, which had extended out ahead in the nose of the bomb pod, was mounted in the nose of the aircraft, enabling the pod to be shortened. In August, 1954, the airframe was redesigned for the last time in the light of the supersonic "area rule." The jet engine nacelles were hung individually under the wings, the fuselage redesigned, with added room for fuel permitting the tip tanks to be eliminated. Wind tunnel tests confirmed that a significant increase in supersonic performance could be expected. This design was unchanged up to the date of the first flight on November 11, 1956, though for some time further the pod carried small canard lifting surfaces forward, and triangular wings amidships.

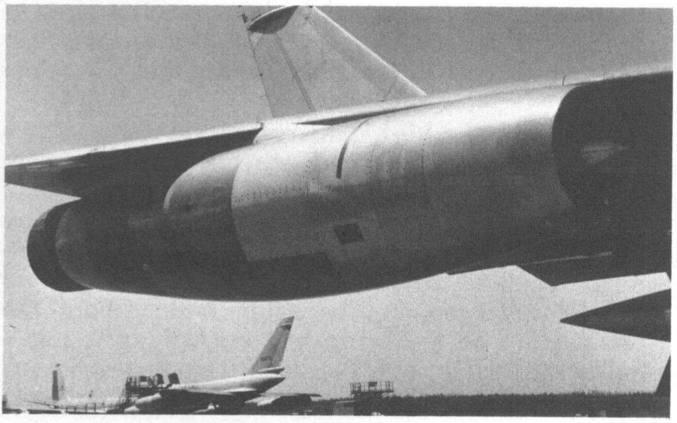
Among the many revolutionary advances embodied in the B-58 Hustler was the use of new procedures and materials in constructing the aircraft. Special demands were made on the airframe structure, not only in terms of aerodynamic loads, but also by virtue of its high speed, which through skin friction at Mach 2 could heat the exterior surfaces above 250 degrees F. With the inboard jet engines venting their exhausts beneath the wing, there was also concern over sonic fatigue at high sound levels affecting the wing structure. In tie-down tests Convair actually ran the inboard engines of a B-58 for ten hours with afterburners in maximum re-heat and sound levels up to 171 decibels to test the wing structure for sonic fatigue.

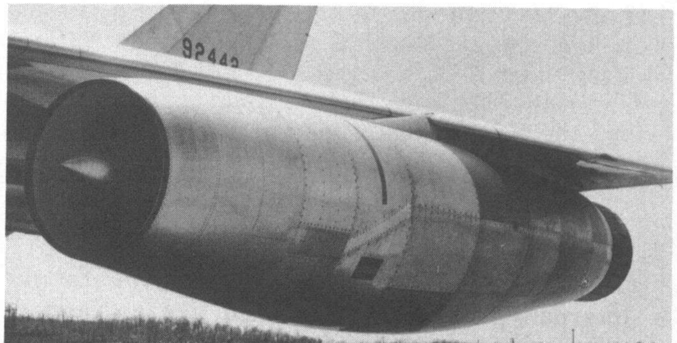
Internally, the B-58 is framed like a Navy destroyer, with transverse duralumin spars, corrugated for strength, spaced only 11 to 15 inches apart running from one wing margin through the fuselage to the opposite wing. There are no chordwise ribs, only chordwise members or bulkheads to serve as attachments for elevons, engine nacelles and landing gear. For covering the wing, Convair evolved a new material — at once stiff, strong, light, relatively easy to replace, and with good thermal-insulating qualities — the so-called bonded sandwich panel. The top and bottom of the sandwich are sheets of duralumin alloy about 1 mm. thick; the half-inch-thick filling consists of tiny honeycombs of either phenolic resin-fiberglass cloth, or less commonly, of very light gauge duralumin. The core is bonded to the duralumin outer layers with phenolic adhesives and cured at a pressure of 175 p.s.i. at 350 degrees F. for two hours. Absolute cleanliness is essential for solid bonding, and the department of the Convair plant where this was done was known as the "hospital section." The panel is then attached to the wing structure with titanium screws. Because it is absolutely impossible to bend or deform a cured sandwich panel, those with curved surfaces have to be set up in a jig before bonding. Fuselage structure panels are reinforced with beaded inner skins bonded to the outer skins. In a few areas exposed to high temperatures, such as the after portion of jet engine nacelles and the elevons which dip into the blast of the inboard jet units, panels of brazed stainless steel sandwich replace the duralumin and fiberglass ones.

In line with the high-density concept under which Convair engineers designed the B-58, the entire interior of the wing, and most of the interior of the fuselage, are filled with fuel. Actually the space enclosed by the wing and fuselage aft of the crew compartment is divided by bulkheads into four tanks. The largest is the after tank, filling the after portion of the wing and containing a maximum of 39,794 lb. of JP-4 fuel. The forward tank in the forward part of the wing contains a maxi-



Power by General Electric.



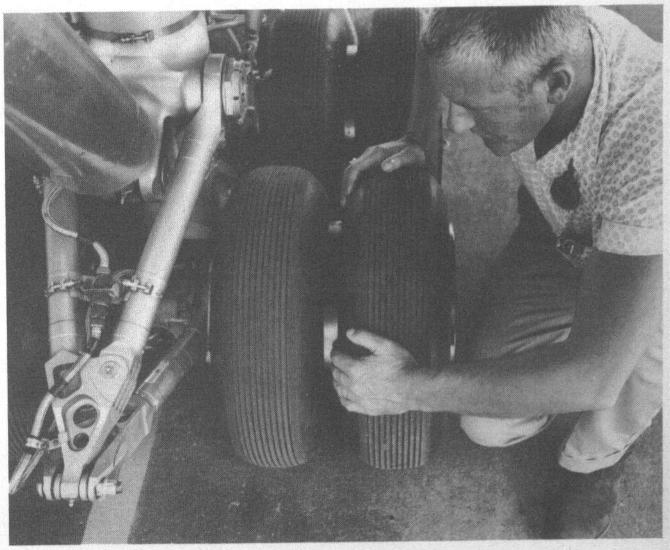


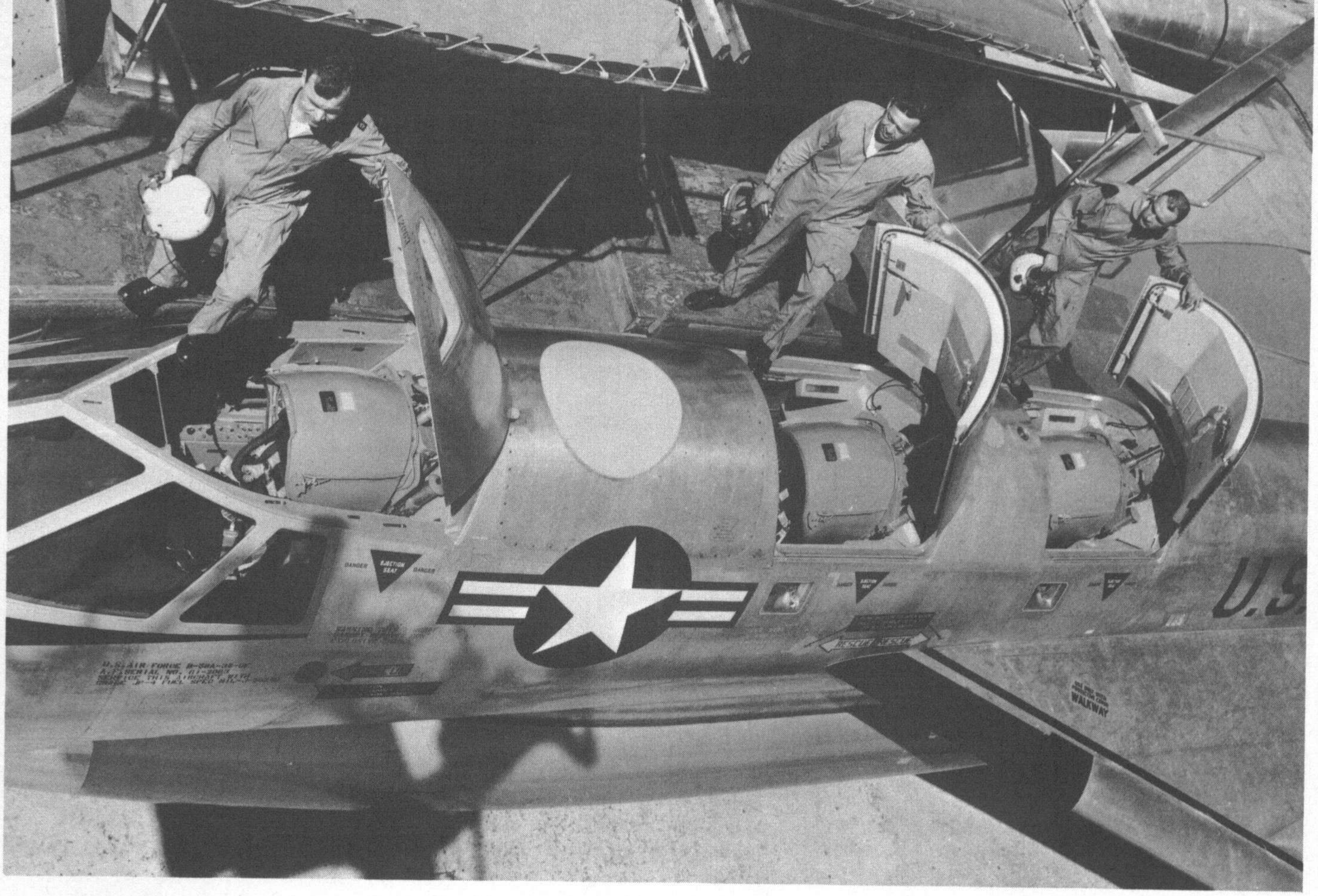
mum of 20,648 lb., and the reservoir tank above the wing, 4,163 lb. In the tail of the aircraft at the level of the elevons is the balance tank, containing a maximum of 8,195 lb. of fuel. The pod or pods carried beneath the aircraft are also largely filled with fuel. The single 57-foot-long MB pod contains mostly fuel. The 54-foot-long lower element of the two-part TC pod, designed to be dropped before run-in to the target, is filled entirely with fuel, while the 35-foot-long upper pod contains at least 2,450 lb. of fuel as well as a warhead. When fully serviced by air refueling, the Hustler can carry in its internal and pod tanks a maximum of 101,627 lb. of JP-4 — over 57% of its gross weight of 176,890 lb. in this condition.

The balance tank in the rear serves a particular purpose. At supersonic speeds, the center of pressure moves well aft of its location at subsonic velocities, and the aircraft's center of gravity should follow it, to reduce drag for the most economical cruise condition. The location of the center of gravity is presented as a percentage of the mean aerodynamic chord (MAC) of the aircraft, and for certain flight conditions the pilot is advised to set the center of gravity at the corresponding correct MAC. (For example, with a gross weight over 100,000 lb. and speeds above Mach 1.3 the center of gravity below 50,000 feet must be kept within limits of 30% forward and 33% aft of the MAC). An automatic computer-controlled programmer will arrange for fuel to be pumped aft from the forward tank to the balance tank, or forward into the forward tank, as necessary to bring the center of gravity within the required limits.

The four engines of the B-58 Hustler — General Electric J 79-5As or 5Bs — are rated at 10,000 lb. thrust at sea level in military power or 15,600 lb. with maximum afterburner. The engines are remarkable for having variable-position inlet guide vanes and variable-position stator vanes in the first six stages of the compressor. These are automatically set in relation to engine speed and compressor inlet temperature, to admit the correct amount of air to the compressor, and to direct it against the rotating compressor vanes at the proper angle of attack, thereby minimizing the possibility of compressor stall. Primary and secondary exhaust nozzle flaps in the engine outlet area provide for optimum thrust and specific fuel consumption under different engine operating conditions, and are opened or closed by the throttles. In addition, they prevent engine overheating. The throttles have six settings, OFF,

240 p.s.i.

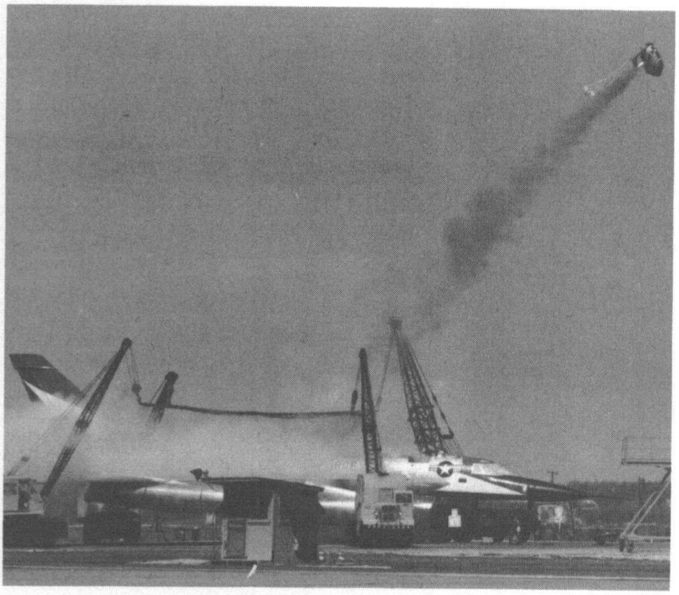




Three crewmen, three escape capsules, three cockpits. From the left: pilot; bombardier/navigator; defense systems operator.

IDLE, and MILITARY. To achieve "design speed" the Hustler has to be driven by the afterburners, and these increase their thrust as the throttles are advanced to MIN A/B, MAX A/B, and OVSP. In the latter setting the engines are allowed to overspeed to 103.5%; operations at 105 to 107% r.p.m. are permitted for five seconds or less, but operation above 107% r.p.m. for any length of time requires that the engines be returned to the factory for overhaul.

Static capsule test.



With a takeoff gross weight of 163,000 lb., and a landing gross weight of 75,000 lb. and a touchdown speed of 165 knots, the landing gear, wheels and brakes of the B-58 take terrific punishment. The steerable nose gear has two tires; the two main gears roll on four non-frangible steel wheels, each bearing two 22-in diameter tires inflated to 240 p.s.i. Should all the tires blow and disintegrate in a bad landing, the aircraft will roll on the non-frangible steel wheels. Enormous amounts of energy, up to ten million foot-pounds per brake, may be absorbed in a normal landing. Even higher energies may heat the brakes to such a degree that tires or hydraulic fluid may ignite, and firefighters must remember to approach the landing gear from front or rear only due to the danger of tire explosions.

Generators driven by # 1, 2 and 3 engines provide 115/200 volt alternating current, which powers most of the instruments, some of the radar equipment, the fuel pumps and some of the navigational equipment. Some of the alternating current is rectified to provide multiple direct current between 28 and 250 volts including caution and warning lamps, autopilot, navigational electronics equipment, and some of the radar apparatus. A 28-volt battery provides a limited amount of power during extreme emergencies. The Defense Systems Operator's cockpit is practically lined with panels of individual fuses which may be checked by running the hand over them, a small pin protruding about an eighth of an inch from a blown fuse. Other fuse panels are in the navigator's cockpit.

There are two separate and independent hydraulic systems, the utility and the primary, each having two engine-driven pumps maintaining a pressure of 3000 p.s.i. Both systems share in the operation of the flight controls, the elevons and rudders; should one fail the other system assumes the full load; should both hydraulic systems fail, the pilot has no means of controlling the aircraft and the crew must eject. The hydraulic systems also operate the landing gear, nose wheel steering, wheel brakes, tail turret, aileron, elevator and rudder damper servos. A pneumatic system is provided for emergency extension of the landing gear and for emergency braking.

There is no physical communication between the three cockpits arranged in tandem, and except for the intercom each crew member is on his own, in cramped quarters which do not permit standing, for missions lasting 7 to 8 hours. The pilot has vision ahead and to the sides through a six-window wrap-around windshield, plus two small windows in the canopy for overhead vision. The bombardier/navigator and defense systems operator have a minute window measuring not more than 4 x 6 inches on each side of their compartments. These might seem to serve solely as antidotes to claustrophobia, but often are covered by opaque cloth curtains the better to view radar scopes within the cockpits. Each cockpit has its own individual, jettisonable canopy, hinged at the rear and moved pneumatically.

Each cockpit also has an individual escape capsule — the first enclosed escape system in an aircraft in regular service use. Flight personnel are "sized" for the capsule at the start of the training course, and failure to fit the capsule is a cause for separation from the B-58 program.

The capsule can be closed and pressurized within 7 seconds in case of loss of cabin pressure at high altitude, enabling flight personnel to dispense with pressure suits. In this situation the pilot can see part of his instrument panel through a window in the capsule door, and with full control through the stick inside the capsule, he may fly the aircraft to an altitude below 40,000 feet and decapsulate. Buttons on the stick enable him while encapsulated to disconnect the autopilot, shift the center of gravity, and retard the throttles. In an emergency, rockets eject the capsule from the aircraft, with the enclosed personnel being protected against wind

176,890 pounds of airplane.

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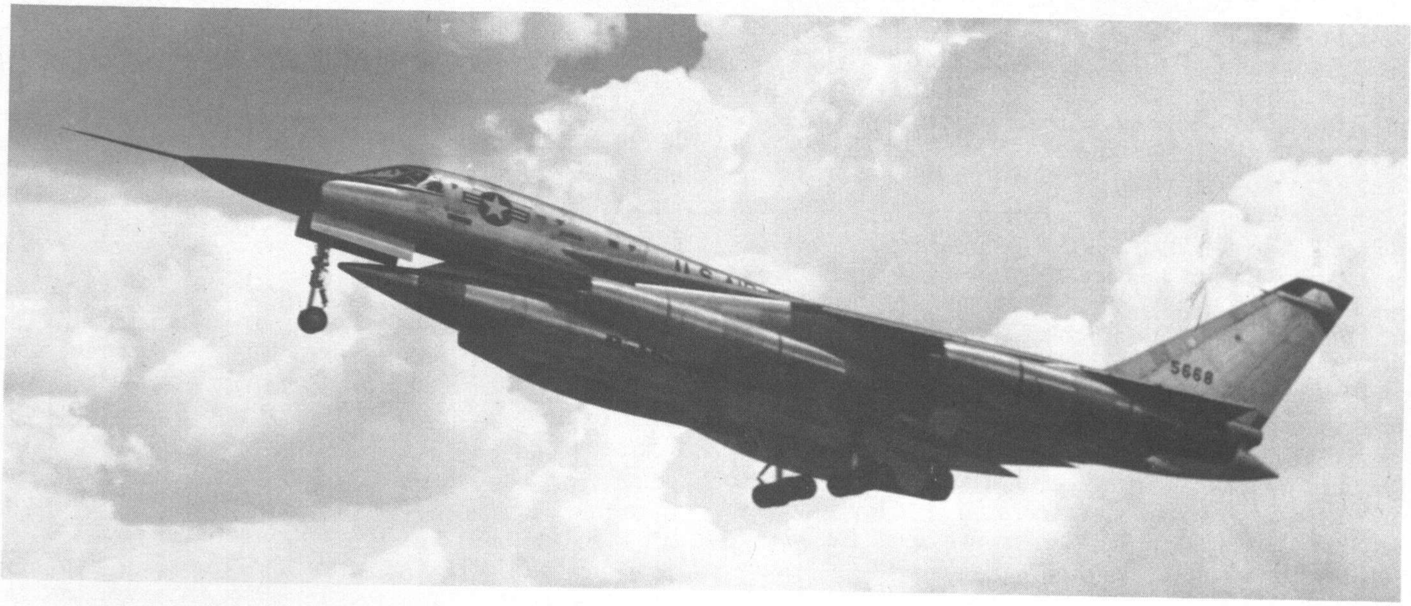
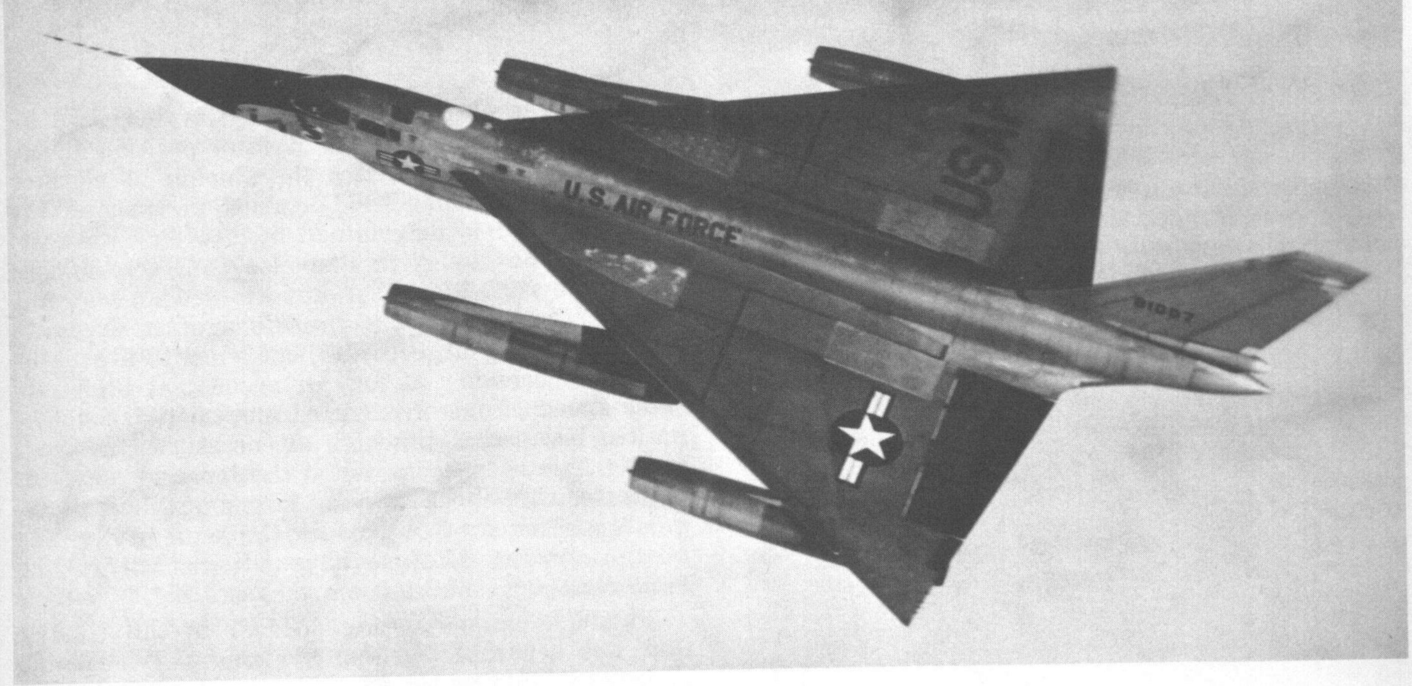


blast, wind blast erosion and thermal injury. After deceleration of the capsule, a 41-foot diameter parachute lowers it. The capsule contains survival gear, including a radio, rations, water, desalting gear, clothing, and a rifle, and will float if it lands in the sea.

Liquid oxygen is carried, and crew members use the diluter-demand regulator, with pressure-breathing masks. The interior of the crew space is cooled by two separate air conditioning systems. This is as much for the benefit of the large amount of electronic equipment carried as for the crew, and in fact, if the amount of air from the cabin cooling system is insufficient to maintain safe temperatures in the electronic gear, the cooling plant goes into "reverse flow" and the electrical equipment is cooled before the cabin. A pressure regulator in the cabin exhaust vent maintains a pressure differential of up to 7.45 p.s.i.

As for the electronic equipment itself — I still remember the laughter when I first told members of the 43rd Bomb Wing that I had heard that the Hustler was so complicated and tricky to fly that its operation was completely automated, with control movements automatically programmed by a reel of tape brought out from Operations and stuck in a black box in the nose! The Hustler is still a pilot's airplane, yet the extent and sophistication of the computerized and miniaturized control and navigational equipment is incredible, and enormously extends the perceptions and performance of the three human operators.



TB-58A trainer, BOOMERANG, above Little Rock Air Force Base. Note large side and overhead windows for pilot instructor.

To guide the Hustler, the pilot has a pair of conventional rudder pedals and a massive plastic control stick with which he makes the conventional control movements. Yet he is not moving the rudder and the elevons — the horizontal control surfaces at the rear of the delta wing — but merely activates valves which, through a power control linkage assembly, move the control surfaces by hydraulic force. (Characteristic of the hydraulic control system is the phenomenon known as "stick talk back," the pulsating kick of the control stick when the hydraulic pressure fluctuates at the stick's extreme limits of movement). There is of course no transmission of control surface loads back through the stick and pedals, so artificial feel systems provide a substitute. Other sophisticated features of the flight control system are automatic, responding not to the will of the pilot, but to impulses from the autopilot amplifier computer assembly, which derives information from the air data computer (Mach number, temperature and altitude), the gross weight computer, the tracking and flight controller unit (pitch and roll corrections), the primary navigational system (pitch, roll and heading signals), and the rate gyro and accelerometer package. These assemblies not only control the action of the autopilot (which can even vary engine power), but also the operation of other automatic features of the flight control system. For instance, damper servos move the control surfaces automatically to damp the rate of pitch, roll and yaw, undamped movement of the Hustler at supersonic

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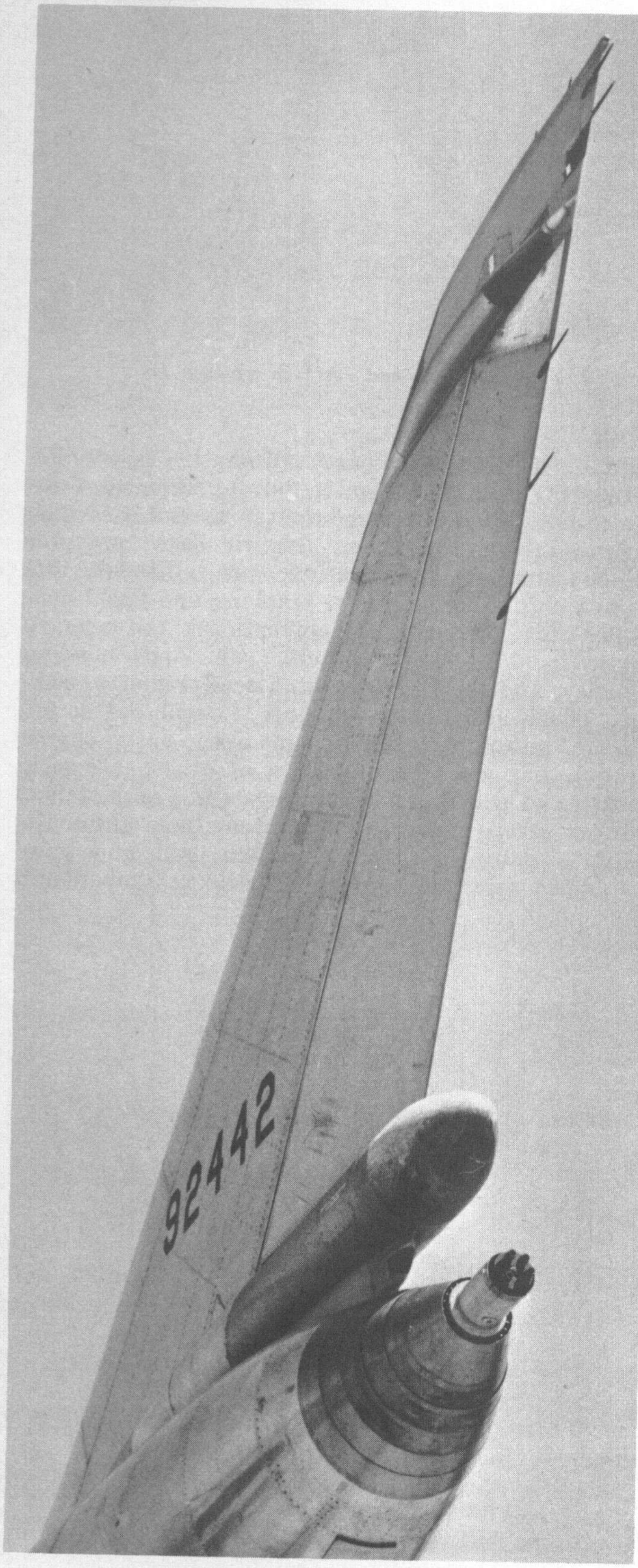
speed, in particular, being dangerous as the aerodynamic loads may exceed the structural limits. An automatic elevator trim system will position the elevons to maintain constant 1G flight with the control stick in neutral. The angle assumed by the elevator will vary with air speed, gross weight and location of center of gravity, and is indicated on the instrument panel on the elevator position indicator. Another dial indicates the amount of elevator movement available. This depends in turn on the air speed, and is determined by the elevator ratio changer. The latter, in response to Mach signals, varies the stick-to-control surface mechanical ratio, in order to protect the aircraft against excessive G loads. Thus, large control movements are desirable and necessary at low air speeds; at high subsonic speeds, control surfaces movement should be limited because of the high air pressures involved; at supersonic speeds, with the control surfaces blanketed by shock waves, larger surface movements are required to produce the same effect. The aileron controls likewise have automatic trim and ratio changers.

So much can go wrong so fast in the Hustler that two separate warning systems — visual and auditory — insistently draw the pilot's attention to any malfunction. On the left side of the instrument panel is a red MASTER WARNING light, and a yellow one marked MASTER CAUTION. When lit, these draw the pilot's attention to warning and caution panels on the right side of the cockpit, where individual lamps indicate the specific trouble — "left (fuel) manifold low pressure," "oil low #1," "reservoir tank not full," "aft pump #8," "hydraulic utility pump #2," "cabin pressure left," etc. An irresistible attention-getter, a voice warning system, has been developed for the Hustler: into the masculine chatter in the pilot's earphones a

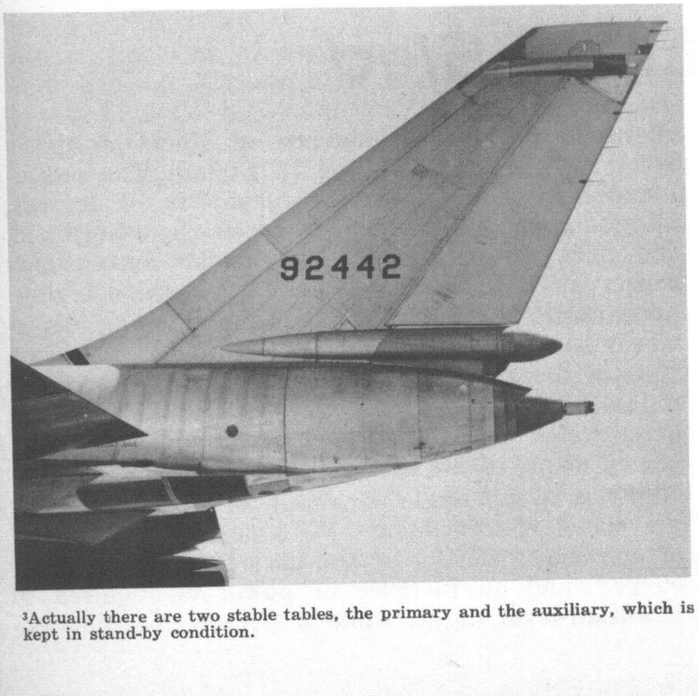


Vulcan tail stinger.

soft feminine voice (pre-recorded, unfortunately) breaks in with one of twenty announcements — "weapon unlocked," "hydraulic system failure," "check for engine fire," "nose too high." What dreams, I thought, the Hustler pilots must dream of this disembodied angel who watches over their destinies! I was speedily disillusioned. "I've seen her," shrugged one, nonchalantly. "She's just like all the rest of them."

Of all the magically-performing electronic gear aboard the B-58, the Sperry-built AN/ASQ-42 bombing/navigation system gives the most astonishing performance. When operating in the navigation mode, it is literally capable of directing the B-58 Hustler, by acting through the autopilot, along a great circle track at constant Mach number and altitude to any point on the globe. The navigator simply sets the latitude and longitude of his true present position on his navigational control board, and the latitude and longitude of his destination position on the sighting and test panel. The computer filling the front of his cockpit does the rest, though not without the aid of a variety of sophisticated sensors which feed it data.

Towards the rear of the aircraft, in the fuselage between the forward and after fuel tanks, is the inertial navigational system, the so-called stable table,[3] whose attitude is gyroscopically fixed while the aircraft moves around it in pitch, roll and yaw. It also provides a secondary measure of ground speed. The primary ground speed source is a Doppler radar transmitter and receiver enclosed within the tail of the aircraft, measuring the true ground speed by the decrease in frequency between the transmitted radar pulse and the echo returned from earth. Atop the stabilization unit, and protruding slightly above the skin of the fuselage, is the rounded cupola of the star tracker unit. By setting on his astro control panel the Greenwich Hour Angle, the sidereal hour angle, and the declination of the sun or star to be used for navigational purposes, the navigator can cause the astro tracker to lock onto the heavenly body, after which it will provide continuous heading information to the computer. Should the celestial bodies be obscured, heading data comes in from the remote compass transmitter inside the leading edge of the fin. Search radar in the nose, displaying a radar representation of the terrain below on the scope in the navigator's cockpit, provides a further check on position. Crosshairs in the scope itself indicate when certain fixpoints on the ground, pre-set into the computer, are coming into view. A radio altimeter provides accurate height above the terrain. The air data system also feeds true air speed, pressure altitude and air temperature into the computer.



In the bombing mode, the bomb/nav system takes the aircraft on a rhumb line course over the target, compensating for wind drift and Coriolis effect, while offset points and fixpoints set into the machine beforehand come up beneath the crosshairs in the radar scope. During the run-in the navigator, while watching the terrain below on radar, can make small corrections in heading with the tracking and flight control stick in his right hand, which acts through the autopilot. At a time calculated to provide a burst over the target, the bomb/nav system, in the bombing mode, automatically releases the weapon. For practice runs over radar bomb sites, the bombardier/navigator turns on a radio tone signal which is cut off abruptly at the moment of simulated weapon release.

The Defense Systems Operator, in the third cockpit, assists the pilot during flight by reading check lists, advising the pilot on fuel consumption, optimum altitude, and location of center of gravity. His primary duties are in connection with the passive and active defense systems. The former comprises track-breaking electronic equipment designed to mislead and confuse the operators of enemy radar, to enable the Hustler to accomplish its mission unaffected by ground-to-air defenses. The latter includes a 6-barrel Vulcan 20 mm. cannon located in the extreme tail, and the remote-control equipment needed to direct and fire it. Enemy aircraft are presented as blips on the defense systems operator's radar scope, and the fire control equipment automatically locks onto the target, computes the lead and windage, aims the gun and notifies the DSO when to fire it — with the attacking enemy aircraft being at no time visible to the Hustler crew.

After a bewildering afternoon watching flight crew trainees at work in the pilot's, bombardier/navigator's, and DSO's cockpit simulators, I confided to my friends of the 43rd Bomb Wing that it was surely easier to get through four years of medical school than to learn to fly the B-58 Hustler.

"Too bad you can't take the six-month training course and find out," they replied.

I wish I could try it.

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[3] Actually there are two stable tables, the primary and the auxiliary, which is kept in stand-by condition.

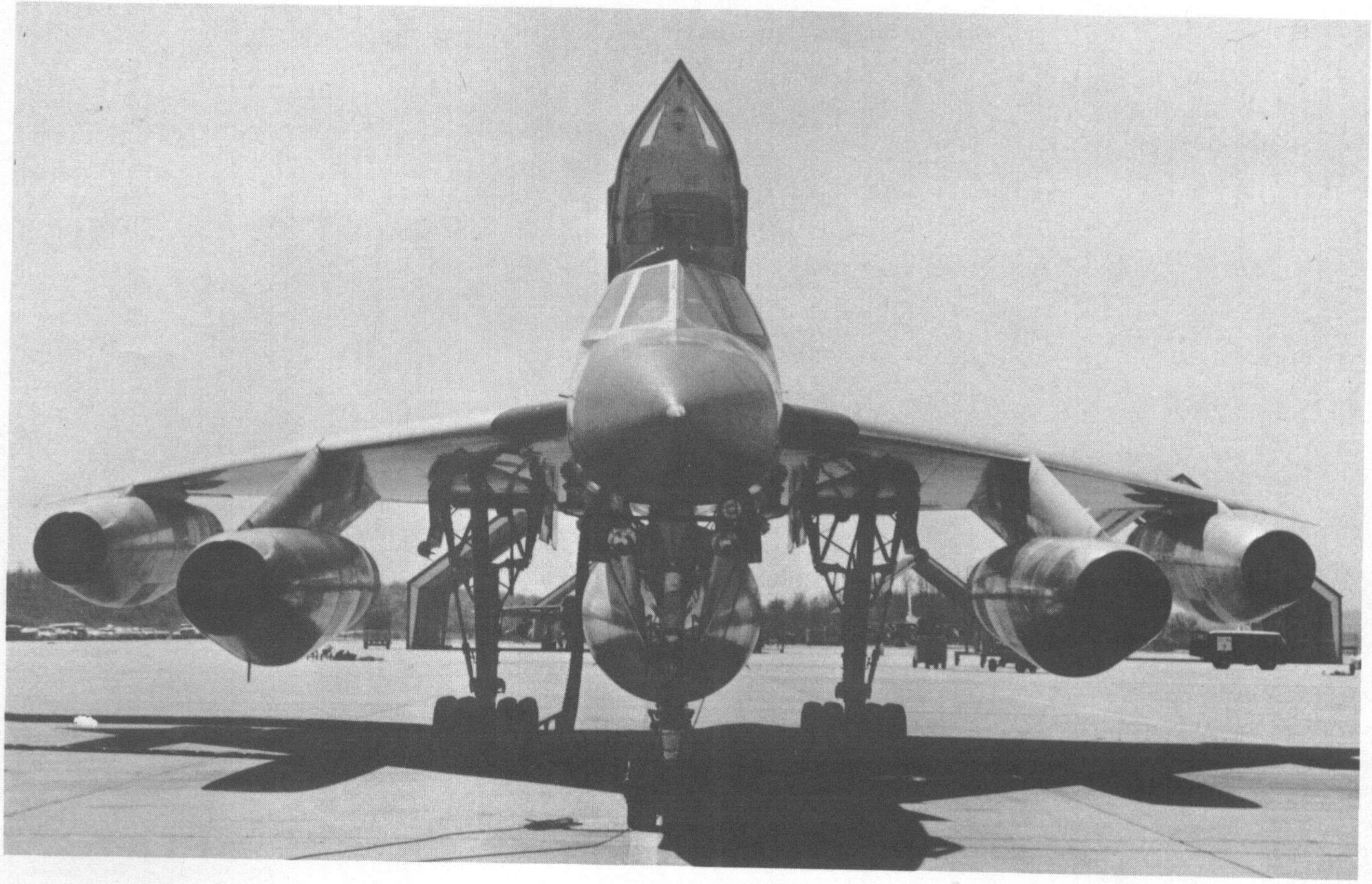
Flying the Lead Sled

"Flying the B-58 is just like flying any other delta aircraft," remarked Major Davis at SAC Headquarters in Omaha, Nebraska. Yet how many of my readers know the handling peculiarities of delta aircraft?

As pointed out in an earlier chapter, the delta wing configuration, with 60 degree leading edge sweepback, was chosen for the Hustler as the planform best suited for supersonic speeds up to Mach 2. At the same time, the aircraft had to be controllable at subsonic speeds, particularly for takeoff and landing. Under these conditions the delta-wing aircraft has some strikingly unusual characteristics in comparison to conventional straight-wing, subsonic aircraft. In flight at relatively low speeds, the Hustler requires a much higher angle of attack than conventional aircraft in order to maintain level flight, as much as 9.4 degrees at Mach 0.5 at sea level with gross weight of 150,000 lb. The recommended angle of attack for takeoff is 14 degrees, and for approach is 12.5 degrees. On the other hand, the delta wing does not stall in the conventional sense, but with the nose pulled higher and higher, maintains forward speed without pitching downwards as would a straight-wing craft. At the same time, with nose elevated, the rate of sink increases unless large amounts of power are applied. With a gross weight of 80,000 lb., the minimum amount of power required to maintain the Hustler in level flight is at an angle of attack of 11 degrees and air speed of 205 knots. With increased angle of attack one is "flying on the back side of the power curve," and an **increase** of power is required to maintain level flight, while the speed goes down —

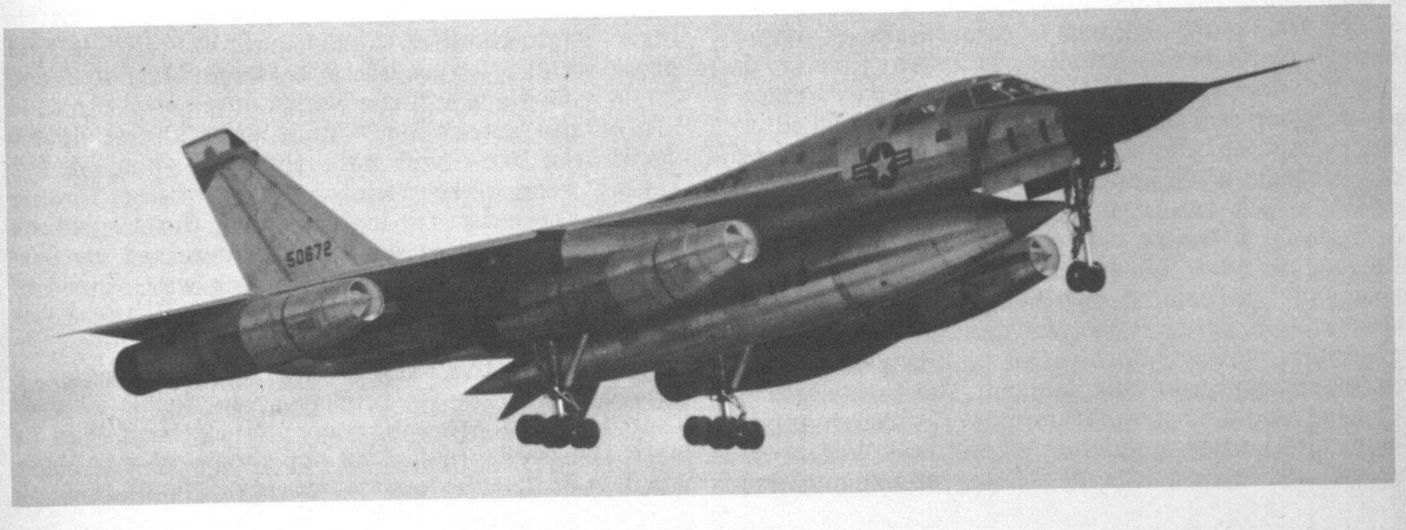
to 148 knots at 17 degrees. Should a high rate of sink develop at these high angles of attack, power must first be increased and if altitude permits, the nose should be lowered. The B-58 is not to be flown at angles of attack higher than 17 degrees, for in this attitude, yawing due to unequal engine thrust, large aileron or rudder deflections, or uncoordinated rudder action may cause the aircraft to pitch up sharply and enter a spin. Recovery from a spin is possible by retarding the throttles to idle, applying full aileron in the direction of the spin, and lowering the nose as the spin stops. Recovery will be impossible if aileron is applied against the spin, or if the center of gravity is abaft the after limit. Needless to say, recovery can be made only if spins occur at high altitude, and if spinning motion has not been stopped before reaching 15,000 feet above the terrain, the crew are to eject. Intentional spins, stalls, inverted flight, and aerobatics of all kinds are forbidden in the B-58 Hustler.

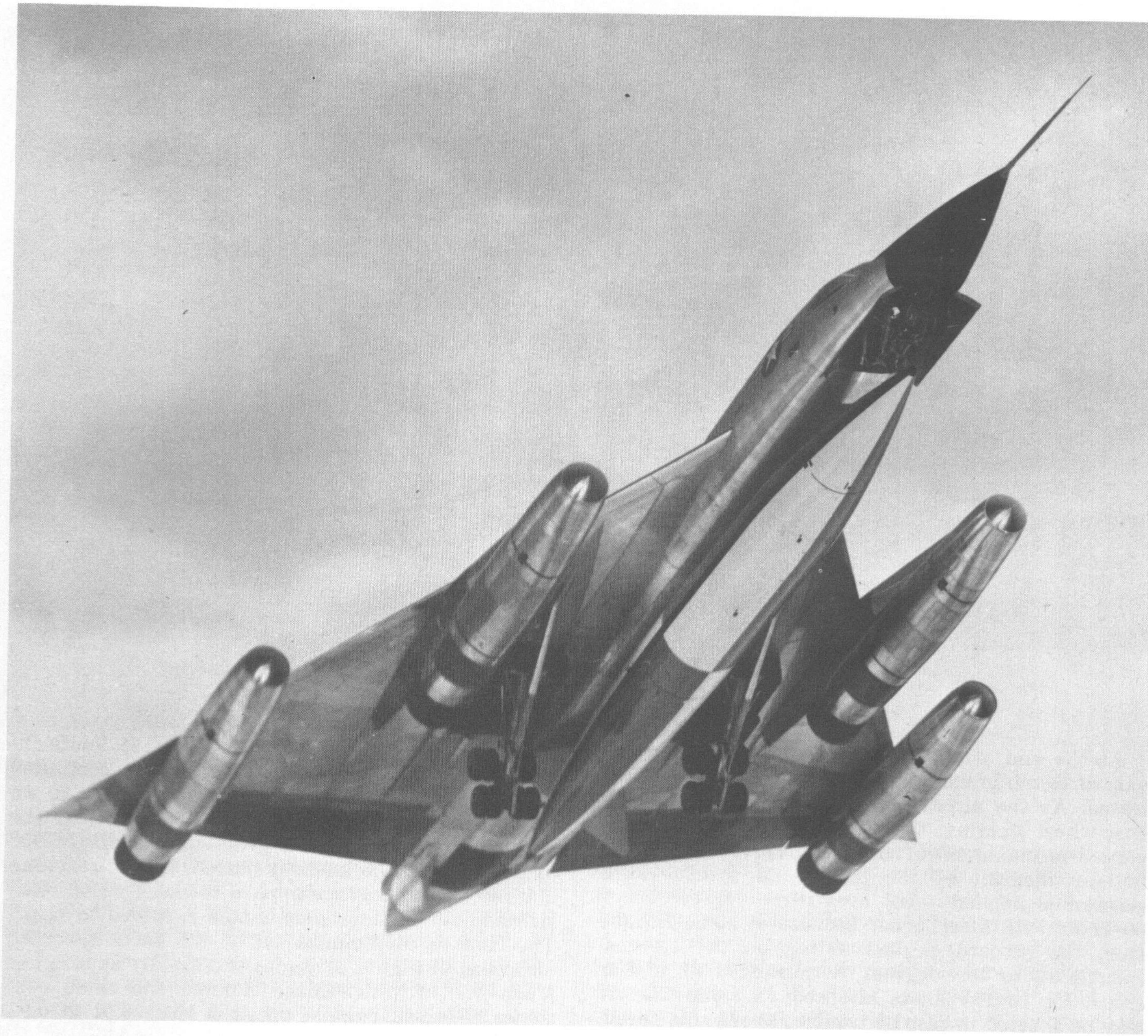
What is it like to fly the Free World's only supersonic bomber? Flight planning takes much time, and commences the day before an assigned mission. Courses are charted, speed and power settings determined, takeoff and landing cards made up, and fuel requirements estimated. Weight and balance are figured with a balance computer for the B-58. On going out to the aircraft, an hour and a half before takeoff time, the crew make a walk-around inspection, checking for loose rivets, fluid leaks, access doors improperly secured, etc. Canopies are opened by a valve in the nose-wheel well, and the crew mounts a wheeled metal stand to enter their cockpits. The pilot, navigator and DSO run through extensive power-off check lists, then with ground cart power, the engines are started, beginning with #2. Suction at the jet engine intakes can pull in personnel, and the danger area extends to a radius of 25 feet in front of each engine. To the rear, the heat and blast from the turbojets



creates a danger space extending 250 feet; at 50 feet, in maximum afterburner, the exhaust velocity is 409 m.p.h. and the temperature 700 degrees F. An engine which does not light off within 15 seconds after fuel flow commences must be shut down and cleared before a second attempt. A "hot start," with excessive exhaust gas temperature for too long a period, may necessitate replacing the turbine. Once all four engines are running, the three generators and the hydraulic pumps "come on the line," and the crew checks out both systems. With no warm-up, the aircraft taxis out at not more than 30 m.p.h. with inboard engines providing power, and nose-wheel steering. Graphs indicate the distance the aircraft may travel before building up excessive heat in the tires; at 165,000 lb. and 80 degrees F. at sea level, the limit is just under 20,000 feet.

At the end of the runway the throttles are advanced to minimum afterburner and the brakes released. As the aircraft accelerates, guided still by nose-wheel steering, the throttles are promptly advanced to maximum afterburner. To counteract the nose-up moment of the jet engine thrust, down elevator is applied — not over three degrees below 60 knots with afterburner because of sonic fatigue from the inboard engines acting on the elevons, though up to ten degrees is permitted at higher speed. Up to 135 knots airspeed (S_1) the takeoff may be aborted in case of trouble; above this speed, the aircraft is committed to takeoff. Beyond S_1 the elevators are eased up to neutral at 165 knots indicated air speed. At 15 knots below computed takeoff speed the nose is raised smoothly to an angle of 14 degrees, and at takeoff speed (S_2) the aircraft lifts off. With a gross weight of 150,000 lb. this is at 203.5 knots indicated. Before reaching 200 feet the brakes are applied to check wheel rotation and the landing gear handle is moved to "Up." The Hustler then climbs out at 425 knots indicated airspeed; at higher altitudes this finally approaches Mach 0.9, at which Mach number the climb continues. The usual cruise speed is Mach 0.91 or 0.92 without pod.





Gear coming up and speed increasing to 425 knots for the climb.

Supersonic flight is always accomplished above 35,000 feet, partly because of time limits in afterburner operations — 30 minutes below this level, and 2 hours above. Before accelerating, dampers are checked, and the center of gravity is checked as being between the supersonic forward limit and the subsonic after limit. The controls for the inlet spikes, which extend in response to the increased differential pressure between a static opening on the engine inlet lip, and a total pressure on the spike tip, are placed in "automatic." With fuel consumption of 1500 lb. per minute in maximum afterburner operation, the after tank is used as only its pumps can meet this demand. The throttles are then advanced from military power through minimum afterburner, maximum afterburner, and overspeed, with checks at each setting of exhaust gas temperature, fuel flow, and nozzle position. Buffeting — a function of Mach number, altitude and gross weight — may occur between Mach 0.9 and 1.1. Above Mach 1.2, the center of gravity is moved aft of the subsonic aft limit. At full supersonic speed, the crew will note that all sound is left behind except the "white noise" of air flowing past the cockpits. On looking along the swept-back wings, they can see the zone of increased air density that marks the standing shock wave ahead of the leading edge. The higher the speed, the closer it comes to the wing. Even at high altitude, skin friction heats the outer surfaces of the Hustler to over 260 degrees F., rendering the inside skin of the cockpits too hot to touch. "Inlet buzz" can be a troublesome problem at supersonic speeds above Mach 1.6. This refers to pressure fluctuations in

Above 35,000 feet; two hours of supersonic travel.

the inlet area of the jet engines, and can be felt as a vibration of the airframe and sometimes heard as a low rumble. It may be associated with low engine r.p.m., and should disappear if the corresponding inlet spike is retracted.

During deceleration, the center of gravity is moved forward to the subsonic position before reaching Mach 1.2, usually by pumping fuel from the balance tank to the forward tank. Spike control switches are set to "in."

On most B-58 missions there is one air-to-air refueling from a KC-135 jet tanker at about 25,000 feet. The air refueling area, the air refueling control time, and the air refueling control point are all embodied in the flight plan. With the KC-135 tanker orbiting in a left-hand race track pattern over the air refueling control point, the B-58 receiver calls up the tanker from as far as 150 miles away, sending a simple coded number identification signal via radio rendezvous beacon. As the aircraft sight each other the tanker should be accelerating to 325 knots calibrated air speed, while the bomber will be decelerating to the same velocity. The tanker lowers from under its tail a refueling boom which, by means of small movable surfaces controlled by the boom operator, can be "flown" up or down, to right or left, while the probe in its tip may be extended a distance of 12 feet. With the tip of the probe in the refueling door atop the nose of the B-58, and within sight of the pilot, JP-4 jet fuel is transferred to all tanks at the rate of up to 5500 pounds per minute. The bomber pilot and boom operator are ordinarily in communication by voice radio, and with the words "breakaway, breakway,

by
[illegible]

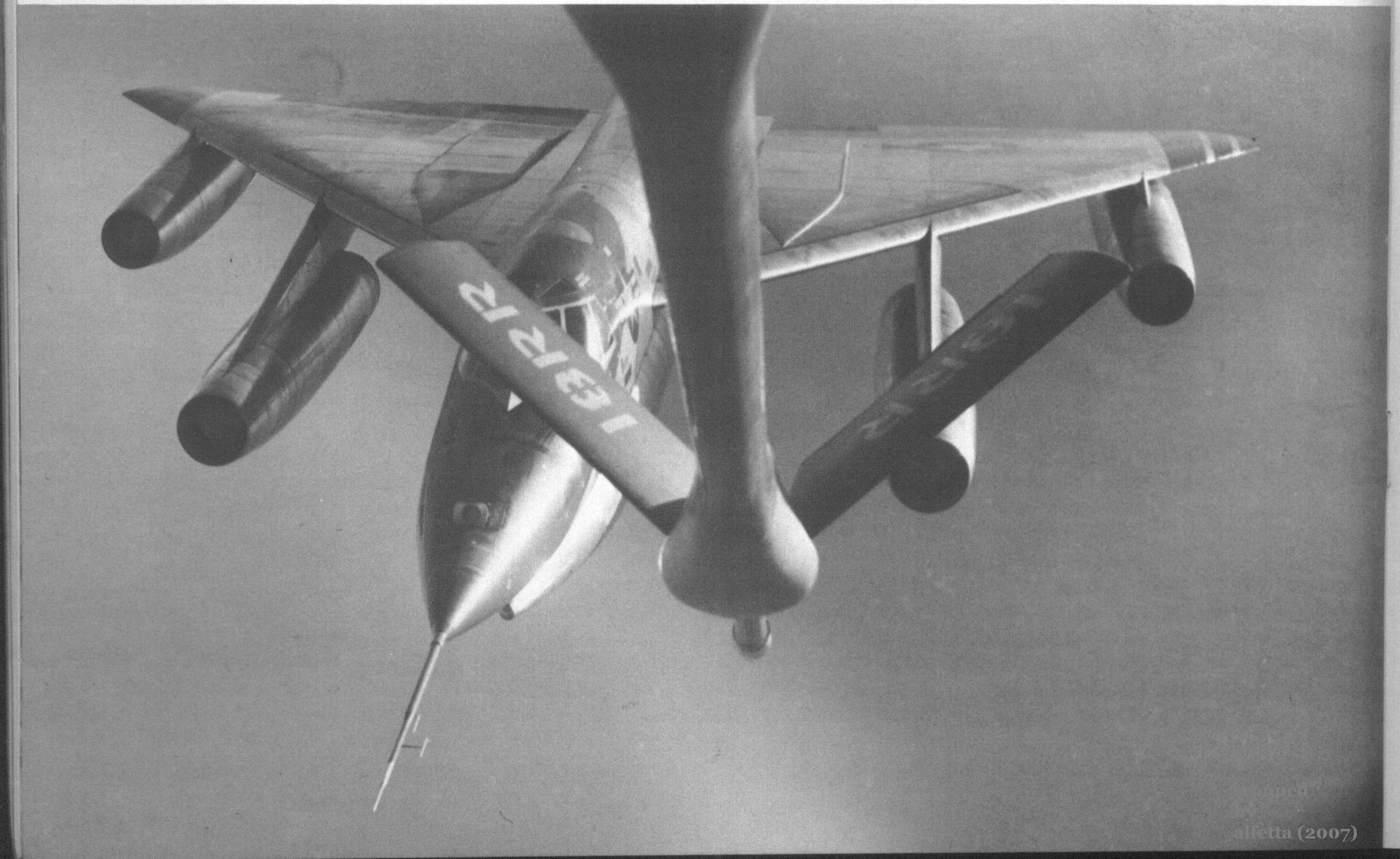
S. AIR FORCE
92436

The filling station waits five miles up.

breakaway!" either can initiate a disconnect in case of emergency. The tanker pilot increases power to climb straight ahead, as the receiver pilot retards throttles and gently lowers the nose to move down and aft while keeping the tanker in positive visual contact until the desired separation is assured. The boom will also disconnect automatically if excessive pressure builds up in the receiver's fuel manifold, or if the receiver maneuvers outside the limits of motion of the boom. Lights on the tanker and inside the refueling slipway doors of the B-58 permit refueling at night as well as by day. A skilful bomber pilot can follow the tanker even in turns and banks without disconnecting inadvertently. On the other hand, any but a light touch on the bomber throttles may cause it to ram the boom, or even the tanker.

With consumption of fuel, the B-58 coming in to land at the end of its mission should have a gross weight of less than 95,000 pounds (regulations

Easy does it — at 375 miles an hour.



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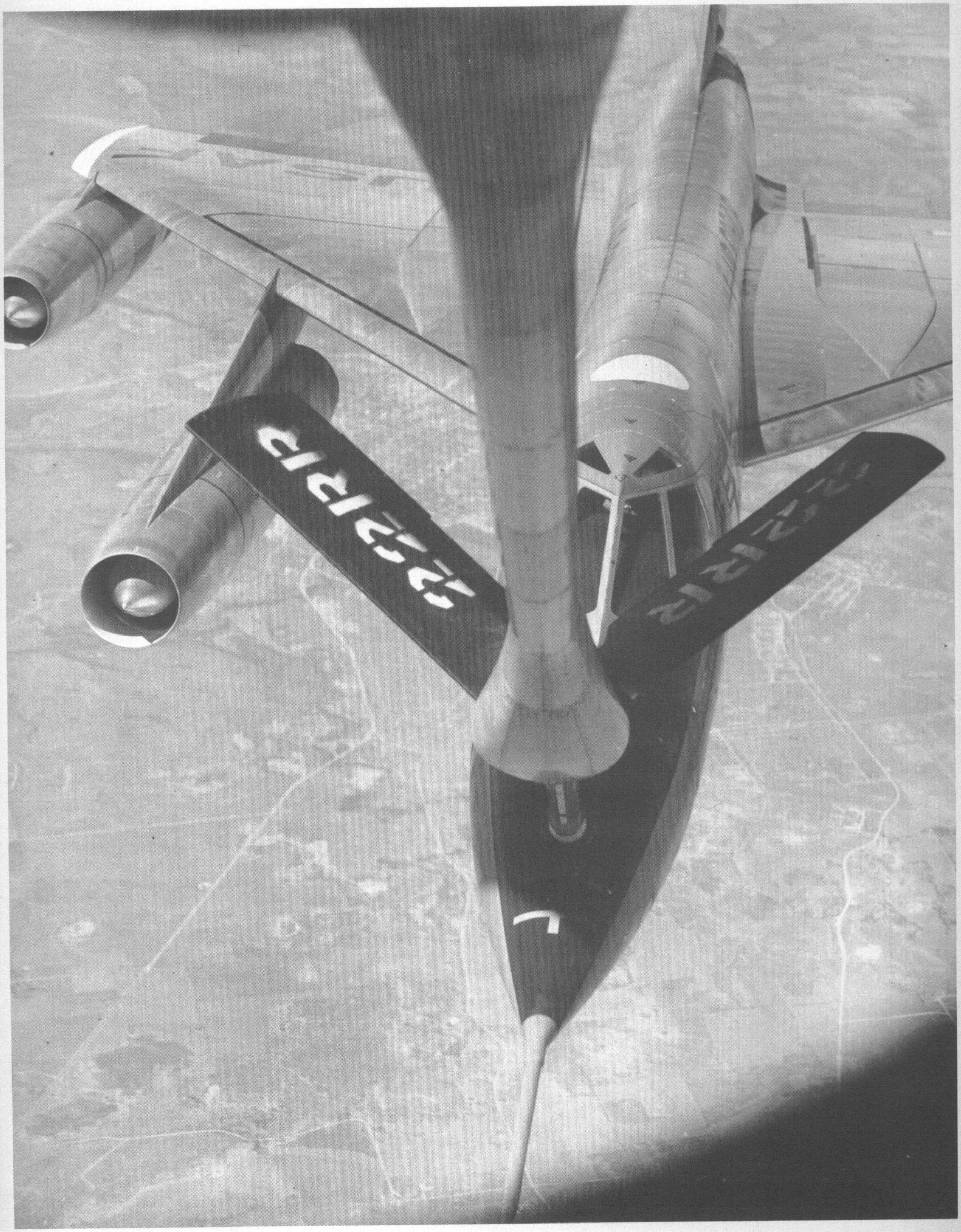
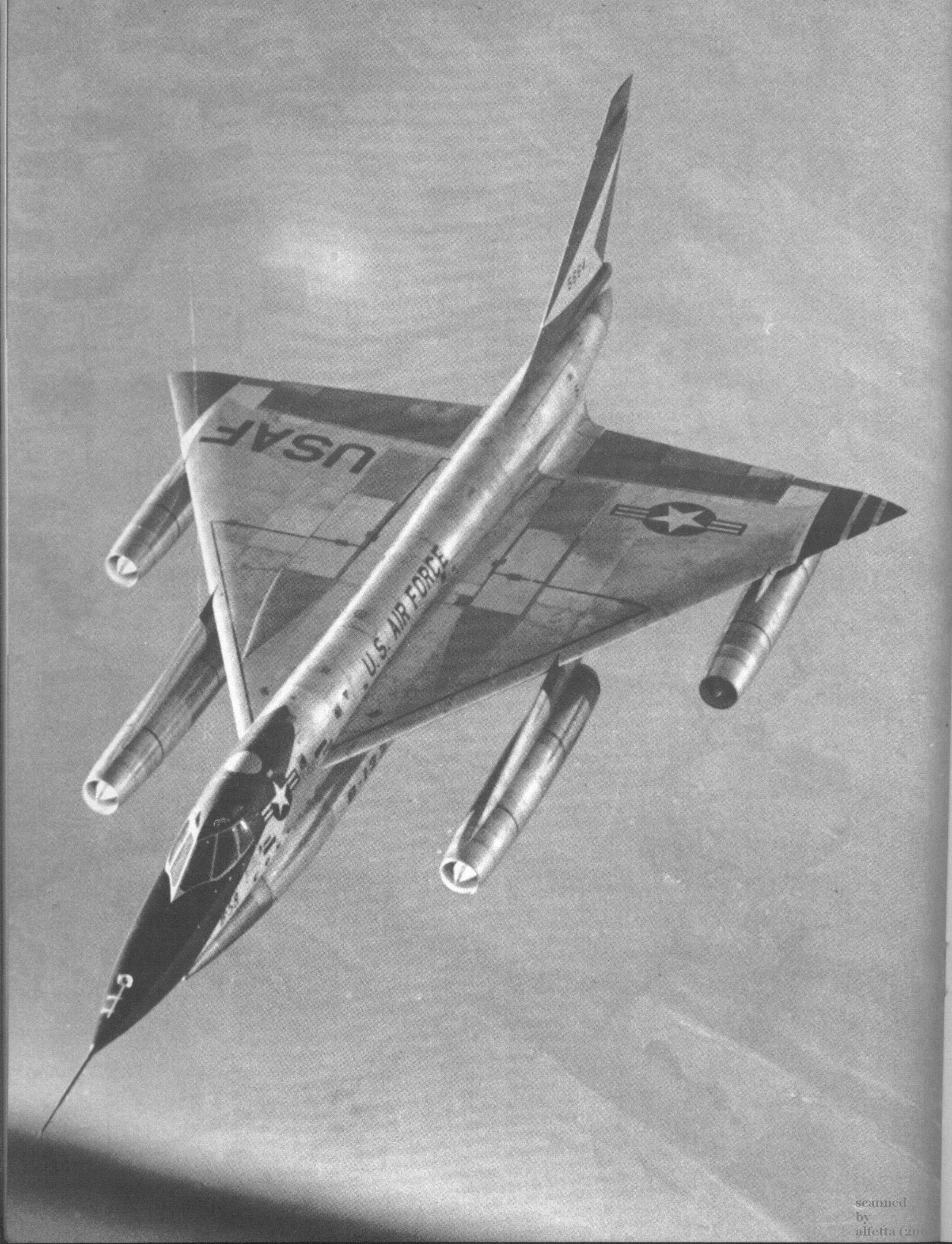


5500 pounds of JP-4 a minute.


USAF
U.S. AIR FORCE

Touchdown at three miles a minute . . .

require that the aircraft arrive over the landing field with not less than 12,000 pounds of fuel remaining for landing emergencies). Approach and landing speeds are relatively high, and it must be remembered that the delta wing does not possess flaps, the entire wing, impinging on the air stream at a high angle of attack acting as a huge flap. The aircraft enters the pattern at 250 knots indicated air speed, and maintains this speed on the down-wind leg while lowering landing gear. On the base leg speed is reduced to 220 knots, and on final, power is reduced to lower the approach speed to 185 knots with gross weight of 75,000 pounds. The air speed, in any case, should correspond to an angle of attack of 12.5 degrees. To attain this angle, the pilot in the cockpit is guided by two simple instruments: an angle of attack indicator, actuated by a vane on the right side of the forward fuselage, which is mounted in the center of the instrument panel; and a small indicator lamp mounted atop the instrument panel at the base of the windshield. A round "doughnut" lamp lights up green when the angle of attack is between 11.5 and 13.5 degrees. At less than 12 degrees, a lower inverted "V" lights up amber, and at more than 12.5 degrees the upper red "V" is lighted. As mentioned before, at higher angles of attack the aircraft is flying on the back side of the power curve, and unless power is added, may sink rapidly while still nose-high. Nor will pulling back the stick decrease the sink rate; on the contrary, the "reverse flap effect" of the raised elevons will force the aircraft down even faster. Normally, the B-58 is flown down a 2.5 degree glide slope on final approach, maintaining the computed flare speed (185 knots in this example), and a 12.5 degree angle of attack with power at approximately 88% r.p.m. Reaching 50 feet altitude, the pilot reduces power slightly (5% r.p.m.) and applies up elevator pressure to "flare" the airplane. The "flare" maneuver reduces the sink rate (vertical velocity) from 840 feet per minute to less than 150 feet per minute and reduces airspeed from flare speed (185 knots) to touchdown speed (155 knots in this example). During the flare maneuver the airplane travels 2900 feet in nine seconds. At touchdown the throttles are reduced to "idle." Military jet engines do not have reverse thrusters, due to the power loss in forward flight, therefore a drag chute is released from the tail and the nose raised for aerodynamic braking. A maximum angle of 15 degrees with chute deployed, and 17 degrees without, may be used to slow the plane. A corollary of the high nose-up angle on the runway is that the pilot cannot see ahead. "When we were at Carswell," remarked the pilots of the 43rd Bomb Wing, "we could always tell how far we had gone down the runway by looking out sideways at the Convair plant. Here at Little Rock we are still learning the landmarks." It follows that the Hustler may be difficult to control on the runway. With water on the surface, wheel braking may be impaired by the "hydroplane effect," and in a cross wind, it may even be necessary to increase power in an up-wind engine to maintain directional control.

Even on the ground, the B-58 pilot's worries are not over. "Remember," warns an advisory from the Chief of the Standardization Division of the 43rd Bomb Wing, "you have to fly the airplane until the engines are cut and the wheels are chocked."

with nose up fifteen degrees.

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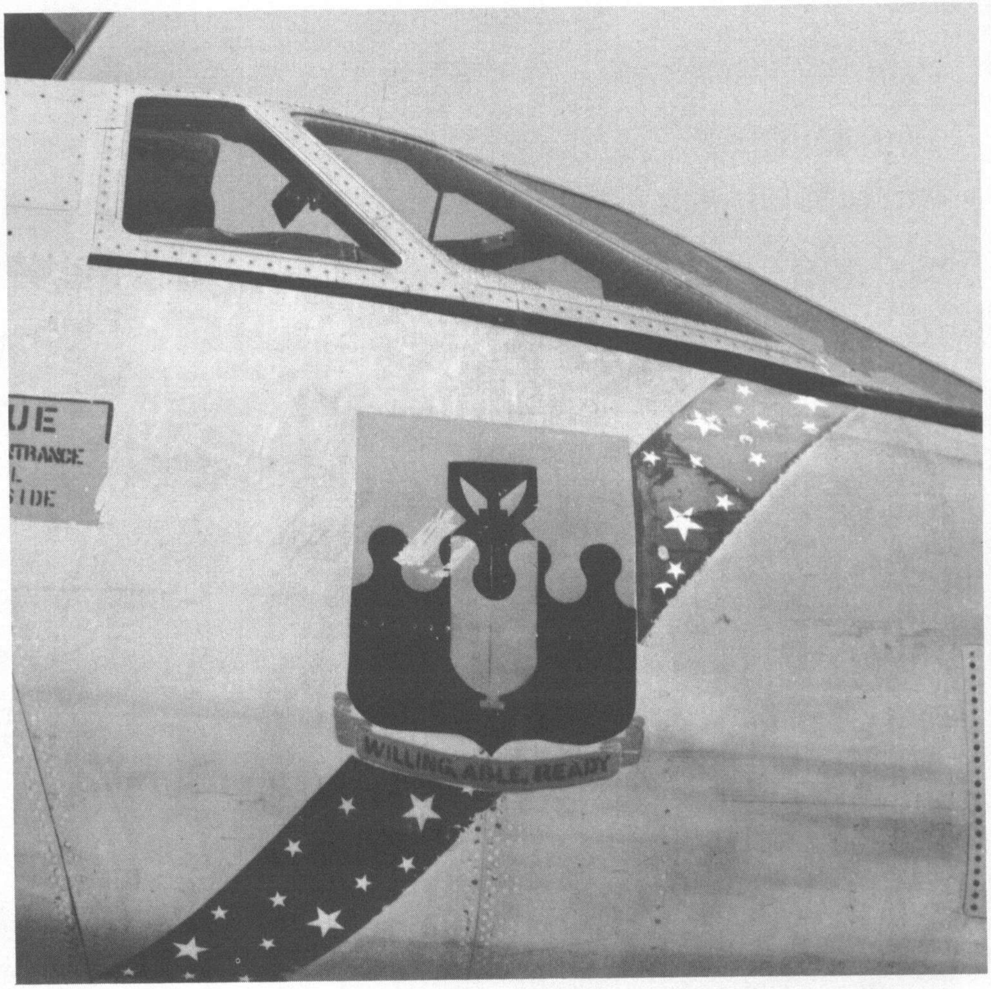

"WILLING, ABLE, READY"[4]

The place of the Hustler in SAC's armory today reflects some of the problems of our leaders in dealing with the threat of Communist aggression in the nuclear age. How is it that despite its extraordinary performance, the B-58 has been procured in such small quantities — only 116 all told compared to more than 600 Boeing B-52 Stratofortresses and about 1800 Boeing B-47 Stratojets, the other manned bombers serving today in the Strategic Air Command? At the policy-making level this fact reflects the "aircraft vs. missiles" controversy in the Defense Department after the first Russian Sputnik confronted the Administration in the fall of 1957 with the spectre of nuclear-armed intercontinental ballistic missiles raining down on American cities. The B-58, which first flew in 1956, had the misfortune to appear on the scene at a time when the bomber appeared to be obsolete, and the Hustler's entry into service coincided with the years of anxiety over the alleged "missile gap." Even today, however, the manned bomber has such advantages over the missile, particularly in its flexibility and

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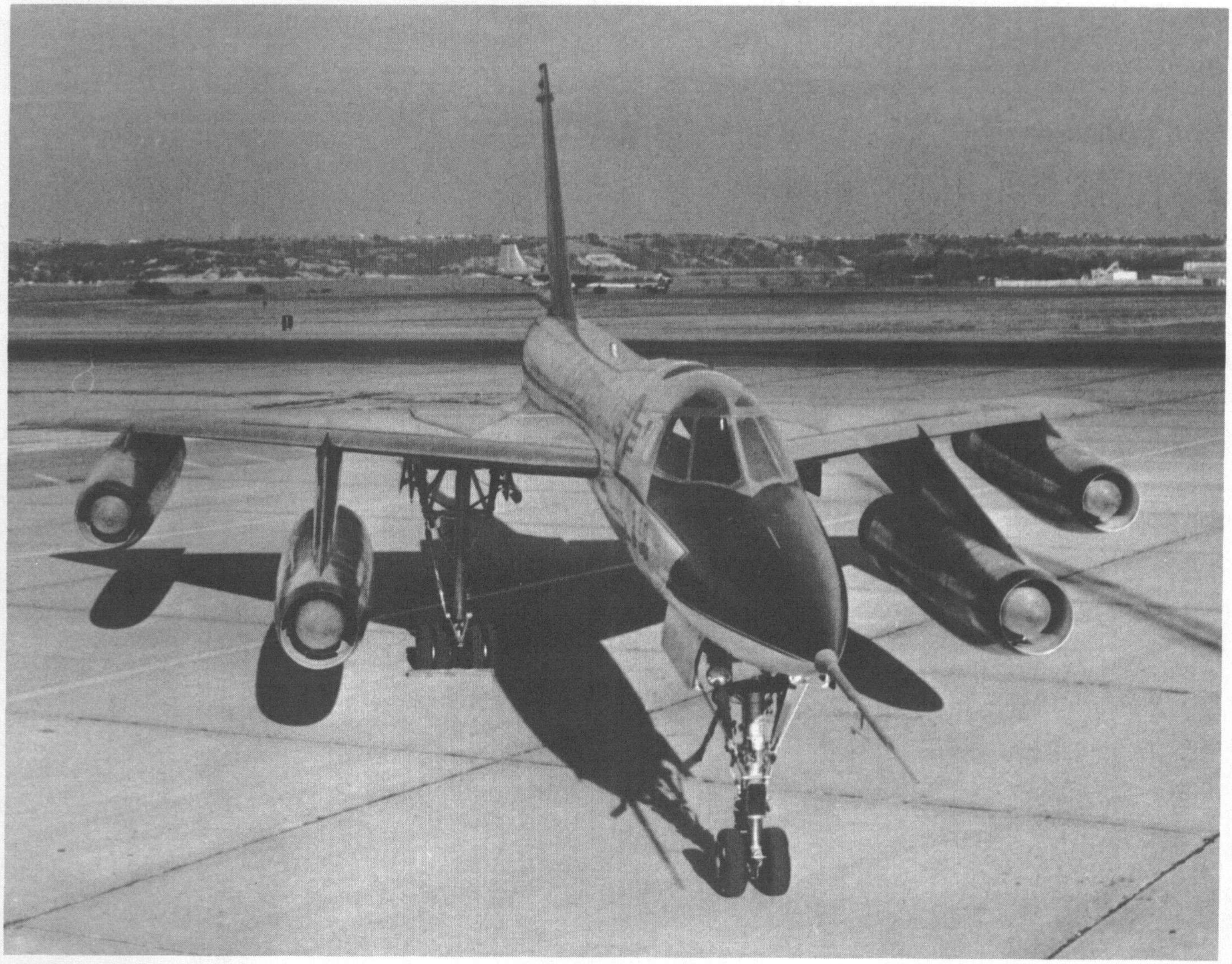
[4] The motto of the 43rd Bombardment Wing (Medium).



"A price of $8,000,000 to $14,000,000 is mentioned."

positive control, that SAC Headquarters still prefers a balanced force of both weapons with which to fulfill its mission of deterring Communist aggression. Yet General Thomas S. Power, Commander in Chief of SAC between 1957 and 1964 was unsuccessful in trying to obtain authorization for additional wings of B-58s despite his "urgent recommendation to do so."[5]

In its early years in service the Hustler had to compete for funds with the early Titan and Atlas missile programs. It was not until December, 1957, that the Joint Chiefs of Staff decided what command would fly the Hustler. In March, 1958, SAC approved the proposed strategic bomber configuration, and by the end of the year had developed an operational concept.[6] Only thirteen aircraft were in the original contract, and even its best friends had to admit that the Hustler at this time had its faults. One was that during its early service the aircraft was full of "bugs," particularly in the hydraulic and electrical systems. The other was expense — the entire program had cost an astronomical $2,300,000,000, which worked out at nearly $20,000,000 per aircraft.[7] This of course would not be a fair figure, but a price of $8,000,000 to $14,000,000 per article is mentioned, depending on whether the cost of alterations and modifications are included. The unit cost obviously would have been less if a larger number of aircraft had been built, and General Dynamics believes that the price of the B-58 would have fallen $1,100,000 below that of the B-52 if 200 had been built.

Thus the 116th Hustler, accepted by the Air Force on October 26, 1962, is apparently the last. The jigs were dismantled, and when there was some later discusion of a further Air Force contract, it was estimated that it would take a year to get production started. In 1964 General Dynamics offered the

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[5] Thomas S. Power, *Design For Survival* (New York: Coward-McCann, Inc., 1965), p. 146.

[6] Lieut. Col. Henry R. Hirsch USAF, "The B-58," *Air University Review*, v. XV, #6, Sept.-Oct. 1964, p. 56.

[7] Hirsch, p. 56.

Number 116, the last of a fantastic breed, rolls out in late 1962.

B-58 to the Australian government, in competition with North American Aviation and French and British aircraft builders, but in the end the Aussies decided they could not afford the price tag on any of them. Production never went beyond the A version. Stillborn were a heavier, all-supersonic model with four Pratt & Whitney J-58 fan jet engines of 30,000 lb. thrust each; an all-supersonic interceptor with two J-58s, Hughes fire control system and GAR-9 missiles; and a projected 55-passenger supersonic transport, also with four J-58s.[8]

Between the date of the first flight of the B-58 on November 11, 1956, and early 1960, much testing was done with the thirty aircraft built under the first two contracts, both by Convair test crews and Air Force personnel. Air Research and Development functions were carried out by the 6592nd Test Squadron, and SAC capabilities investigated by the 3958th Operational Evaluation and Training Squadron, which had the futher mission of training SAC crews to fly and operate the Hustler. On December 30, 1956, the first aircraft "went supersonic," and the first Mach 2 flight was made on June 29, 1957. On September 18, 1959, in a demonstration of low-

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[8] General Dynamics/Fort Worth, pamphlet, "B-58 Hustler."

level penetration capability, a Hustler with a Convair crew flew from Fort Worth to Edwards AFB, California, at nearly 700 m.p.h., never more than 500 feet "off the deck." Following the crash of a B-58 in Deaf Smith County, Texas, on December 15, 1958, in which the Air Force crew ejected at supersonic speed with one death and severe injuries to the two survivors, the Air Force drew up a requirement for an escape capsule in which crew members would be fully enclosed and protected before ejecting into the air stream. Further orders for the Hustler were placed in 1959-61. In September, 1959, the first production B-58A made its first flight, and on December 1, 1959, it was delivered to the Air Force. The time had come for a regular SAC unit to take charge of the aircraft, and the choice fell on the 43rd Bombardment Wing, then stationed at Davis-Monthan AFB, Arizona.

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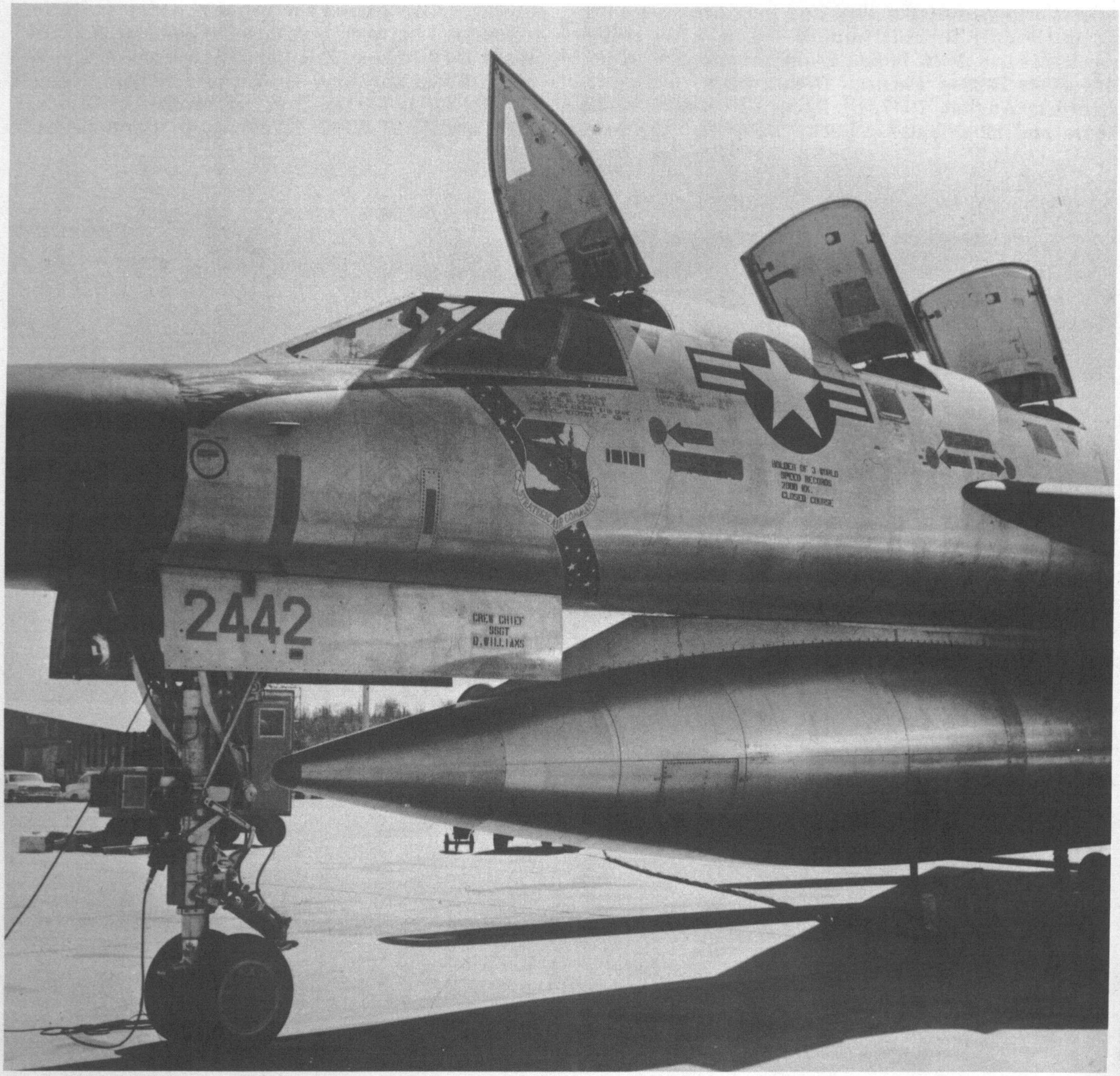
In World War II the 43rd had fought as the 43rd Bomb Group from Australia to Tokyo. After being reactivated in 1946 it had made a name for itself. One of its B-29s, "Pacusan Dream Boat," had set a record in August, 1947, by flying 6,214 miles in 22 hours and 22 minutes. "Lucky Lady II," the first aircraft to fly around the world non-stop (with four refuelings) between February 26 and March 2, 1949, was a B-50 of the 63rd Bomb Squadron of the 43rd Wing. From January, 1954, the 43rd had operated the Boeing B-47, the first jet bomber of Strategic Air Command. When it moved to Carswell AFB,

by
(2007)

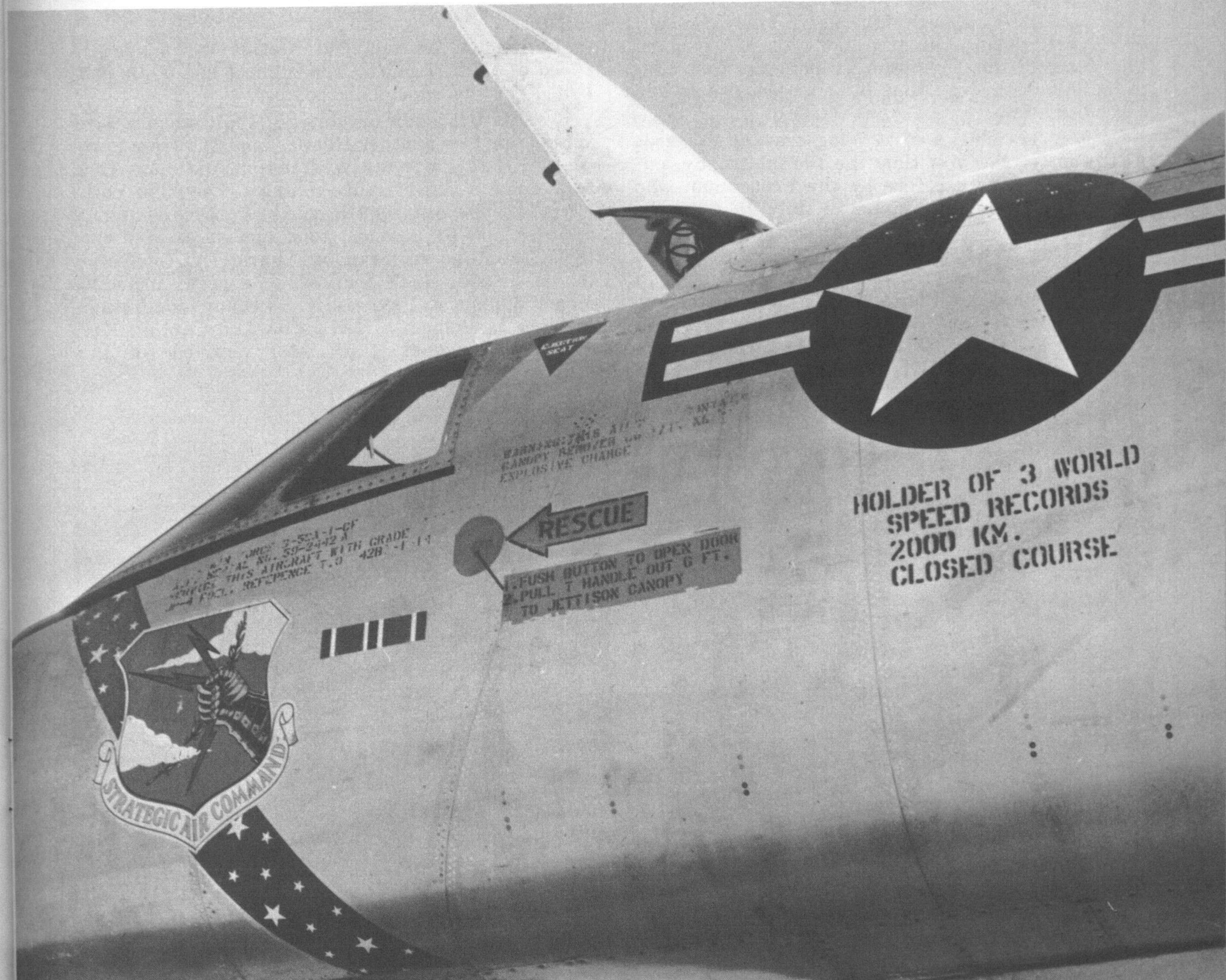
Texas, on March 15, 1960, the Wing absorbed many of the personnel of the 3958th Operational Evaluation and Training Squadron. The 43rd found itself saddled with a frustrating multiplicity of missions: to ready itself to participate in the SAC war mission; to continue testing the new aircraft; and to train its own personnel as well as those of a second B-58 unit, the 305th Bombardment Wing, stationed at Bunker Hill AFB, Indiana.

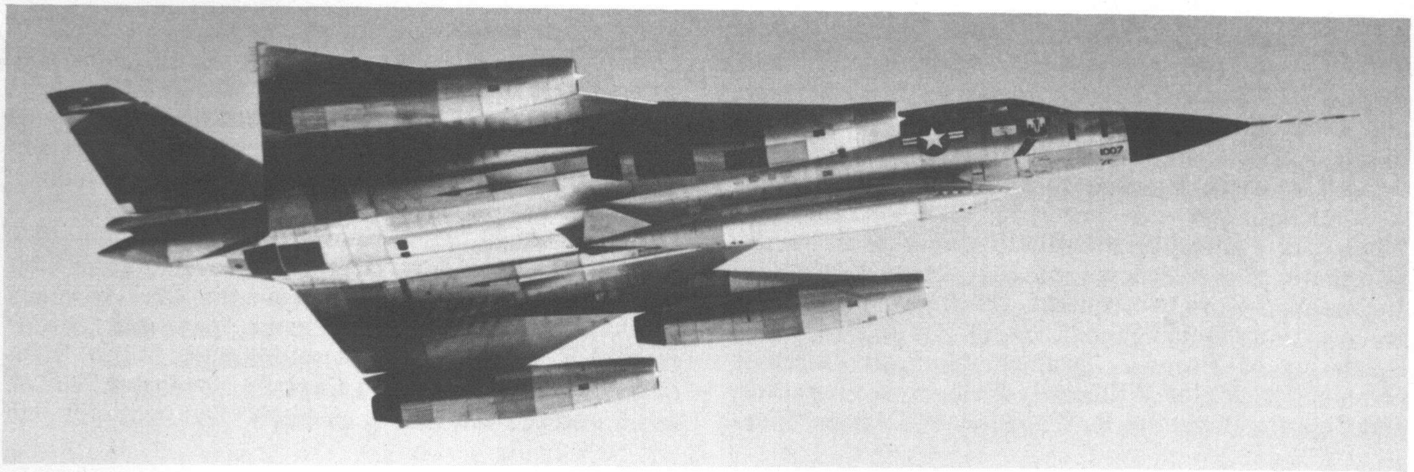
Commanded by Lieut. Col. Curtis E. LeMay, destined to be a later Chief of Staff of the Air Force, the 305th Bombardment Group (Heavy) had flown its first combat mission against Germany on November 17, 1942, and went on to win two Distinguished Unit citations. When reactivated in 1951, the 305th was equipped with B-29s, but in June, 1952, became the first SAC tactical unit to fly the B-47 Stratojet. The 305th served several tours of duty overseas with the short-range jet, and in the spring of 1959 moved to Bunker Hill. Here it received its first B-58 on Armed Forces Day, 1961. "Can Do" has been its proud motto from the earliest days.

Crack flight crews of the 43rd promptly set out to make a reputation for the Hustler. As early as March 23, 1960, Lieut. Col. Leonard M. Legge and his crew flew a B-58, with two in-flight refuelings, for 18 hours and 10 minutes, an endurance record that stands to this day. The aircraft traveled 11,000



miles at an average speed of 620 m.p.h. On August 1, 1960, the B-58 was designated as "operational." A few weeks later, on September 16, a B-58 from the 43rd Wing won the high and low level radar bomb scoring events in the 1960 combat competition against other SAC crews at Bergstrom AFB, Texas — a tribute to the accurate and sophisticated bomb/nav system in the Hustler as well as to the two crews who had flown many practice missions in the weeks before the contest. On January 12, 1961, in operation "Quick Step," a 43rd Bomb Wing crew consisting of Major J. Deutschendorf, Jr., aircraft commander, Major William L. Polhemus, navigator, and Captain Raymond R. Wagener, DSO, flew "Firefly" over a 2000 kilometer course at Edwards AFB, California, at an average speed of 1061.80 m.p.h. to set new international records with payloads of 0, 1000 and 2000 kilograms. Deutschendorf's speed far surpassed that of the Russian Tu 104 which had set the previous records in October, 1959, but he would have done better had he not been fully loaded with fuel which was required to complete the 2000 km. course. Two days later, flying over a 1000 kilometer course, another crew from the 43rd averaged 1284.73 m.p.h. with the same payloads. Major Harold E. Confer, aircraft commander, Major Richard Weir, navigator, and Captain Howard S. Bialas, DSO, entered the course at 44,000 feet, ascending to





50,000 feet during the run. For this achievement they received the Thompson Trophy, the first time in its 33-year history that it had been awarded to a bomber crew.

On May 10, 1961, a 43rd Wing crew at Edwards AFB won for the first time the Bleriot trophy, put up thirty-one years before by the Frenchman who first flew the English Channel on July 25, 1909. To win the trophy, the successful aircraft had to average 2000 km. per hour (1242.74 m.p.h.) for at least 30 minutes — an utterly visionary requirement in 1930, but well within the capabilities of the Hustler. In thirty minutes and forty-three seconds the B-58 completed the closed 670-mile course through parts of California, Arizona and Nevada at an average speed of 1302.07 m.p.h., the highest speed yet published for the supersonic bomber.

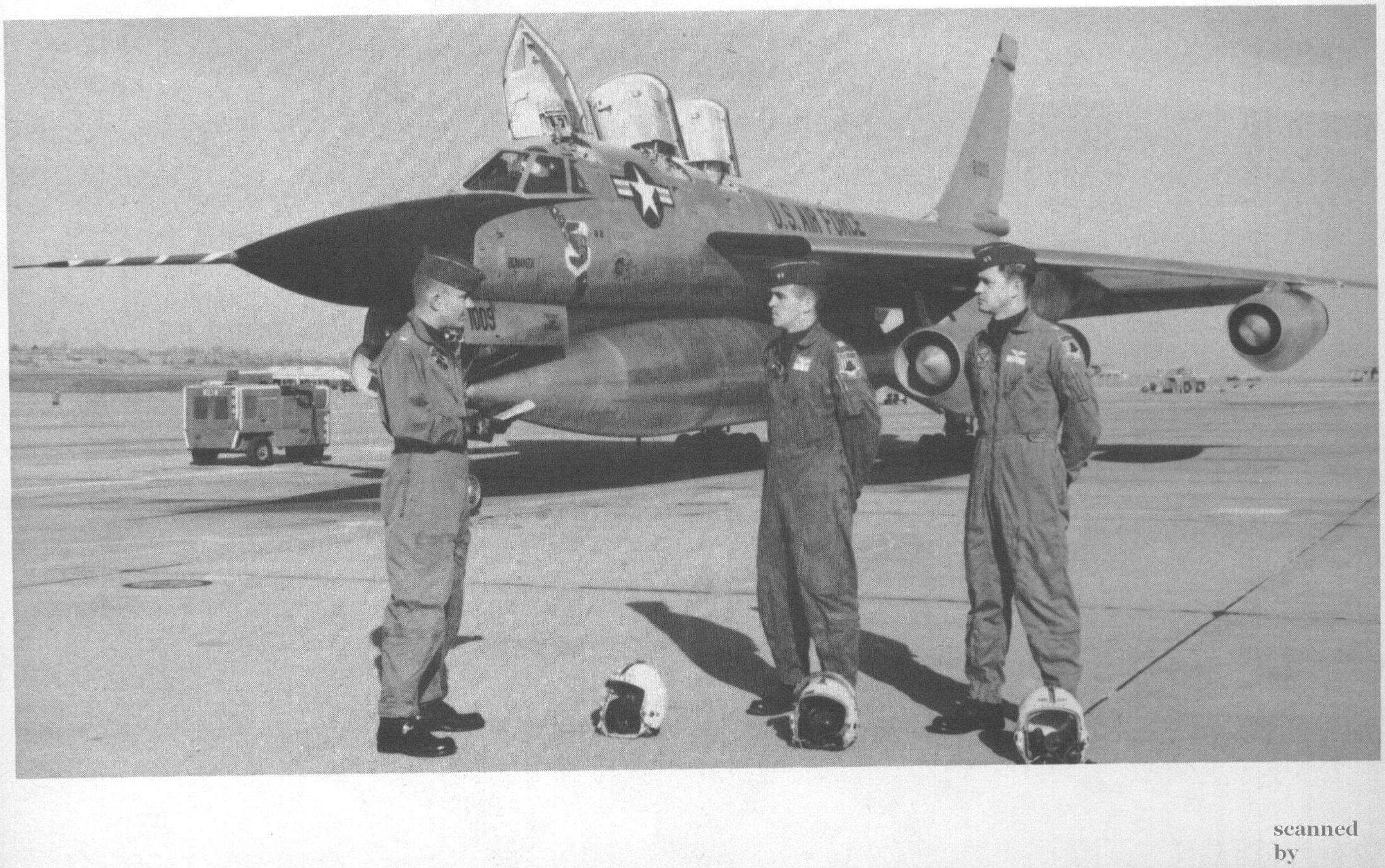
Records fell again on May 26, 1961, when a 43rd Wing crew flew another Hustler non-stop from Carswell AFB to Paris via Washington and New York in five hours and fifty-five minutes. The New York-Paris leg, flown at 1089.36 m.p.h. in three hours, 19 minutes and 51 seconds, took almost exactly one-tenth the time required by Charles A. Lindbergh in his historic 1927 journey. The crew, including Major William R. Payne, aircraft commander, Major William L. Polhemus, navigator, and Captain Raymond R. Wagener, DSO, later received for this

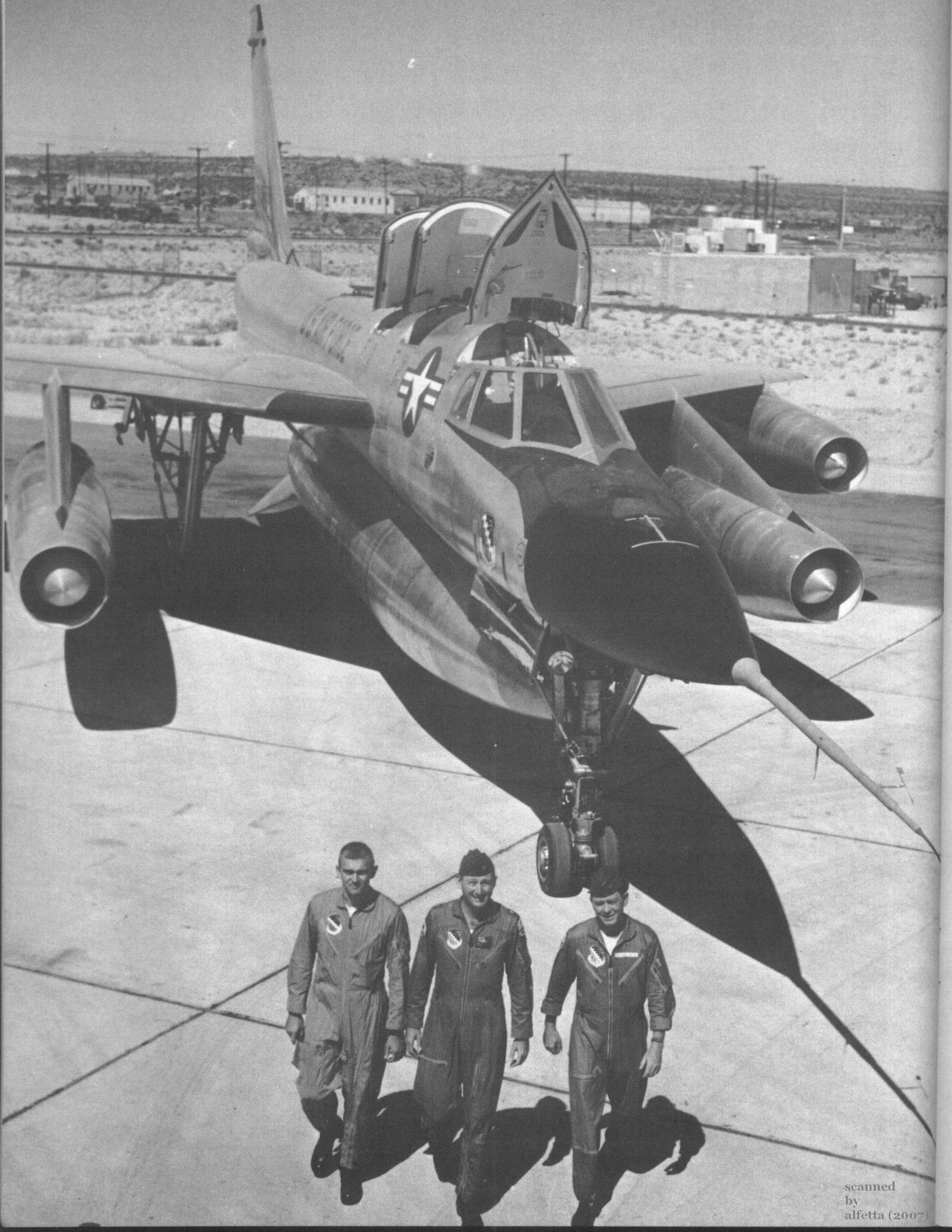
achievement both the Mackay Trophy, awarded yearly by the Chief of Staff, USAF, to "the Air Force person or organization accomplishing the most meritorious flight of the preceding year"; and the Harmon Trophy, awarded annually "in recognition of outstanding and extraordinary feats of individual piloting skill." In a cruel reversal of fortune, this same aircraft crashed and burned on June 3 before 60,000 spectators at the 24th annual Paris International Air Show, after losing control in a low-altitude pass. But Payne's crew was making a television appearance, and the men who died were the Bleriot Trophy winners of a month before — Major Elmer E. Murphy, aircraft commander; Major Eugene F. Moses, bombardier/navigator; and 1st Lieut. David F. Dickerson, DSO.

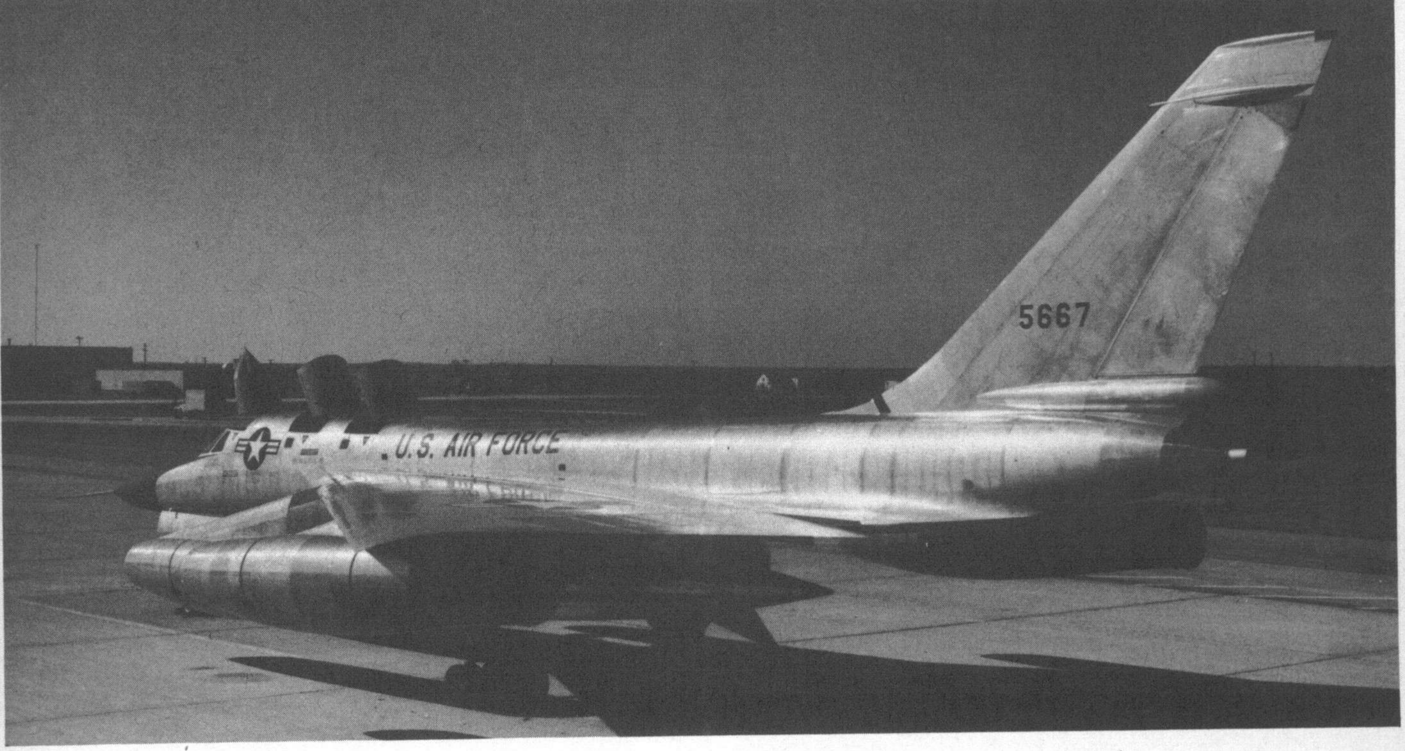
On March 5, 1962, another 43rd Wing crew won the Mackay Trophy for the second year running, as well as the Bendix Trophy for cross-country flying, with a non-stop dash (Operation HEAT RISE) from Los Angeles to New York and back to Los Angeles. The Hustler was refueled four times, near Los Angeles, over Kirksville, Mo., near New York, and over Kansas City. Each time, to minimize the period at subsonic speed, only enough fuel was transferred to fly the aircraft to the next refueling point. The Hustler set a new record of 2 hours, 58.7 seconds from Los Angeles to New York at 1214.65 m.p.h., and of 2 hours, 15 minutes, 50.1 seconds at 1081.80 m.p.h. on the return flight, which involved "beating the sun" by forty-five minutes. For the first time, but not the last, there were complaints from the public about the "sonic boom." "There was particular trouble around Kirksville," recalled Captain (now Major) Robert MacDonald, navigator, who with Major Robert G. Sowers, Aircraft Commander, and Captain John T. Walton, DSO, made the historic flight. "The sound was apparently amplified there by an inversion. We had lots of damage claims."

Williamson, Barrett, and Kubesch of Operation GREASED LIGHTNING.

On October 16, 1963, in Operation GREASED LIGHTNING, a B-58 of the 305th made the longest supersonic flight in history — 8028 miles from Tokyo to London, via Alaska, northern Canada, Greenland and Iceland, at an average speed of 935 m.p.h. The crew members were Major Sidney J. Kubesch, aircraft commander, Major John O. Bar-


Hustler 81009, BONANZA, of 43rd Wing awaits her crew.





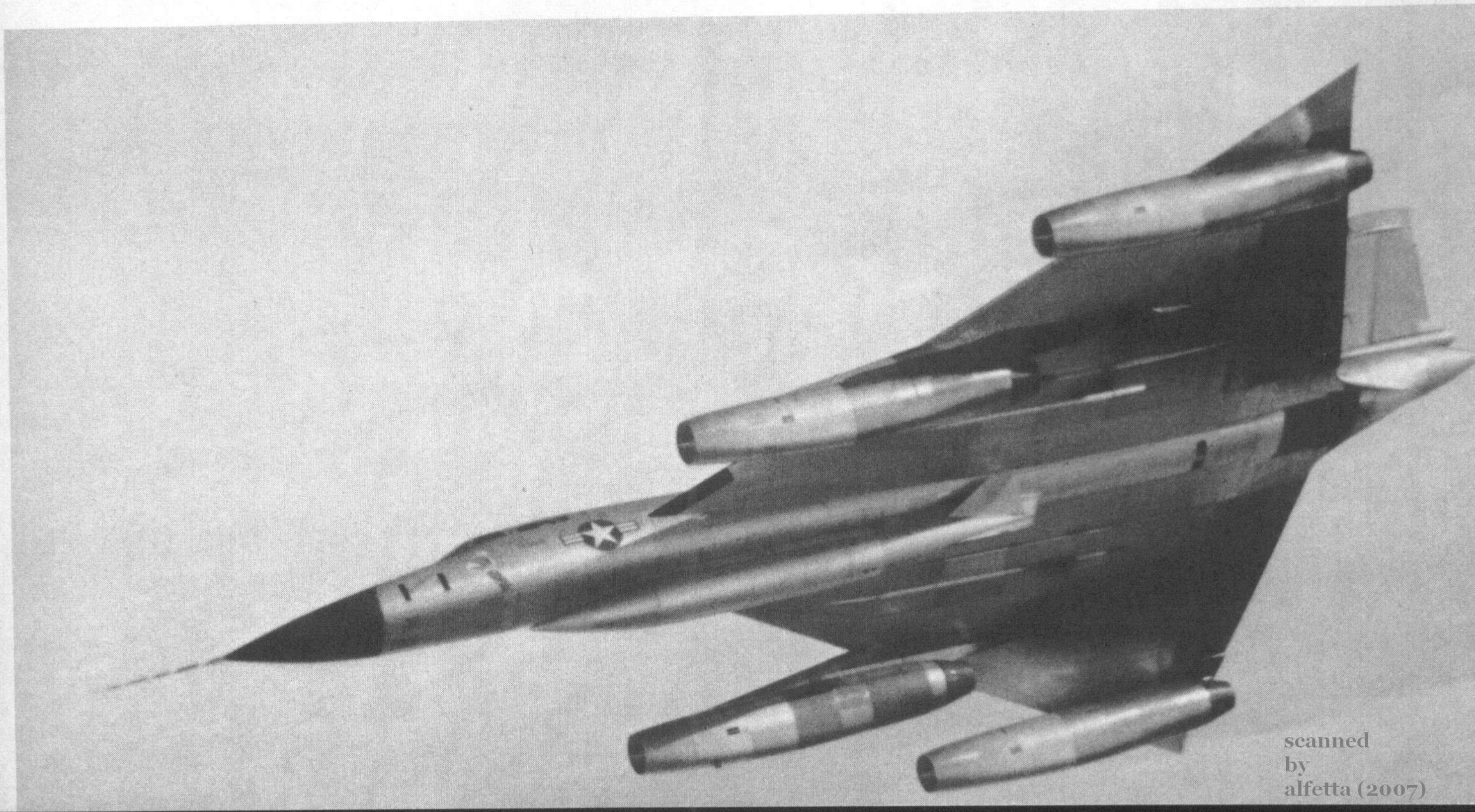
OPPOSITE PAGE: Two records were wrested from the Soviets on September 18, 1962, when Major F. L. Fulton (center) piloted this Hustler to 85,360.84 feet carrying a 5,000 kilogram (11,023 lb.) payload. With him flew Captain W. R. Payne, navigator (right), and C. R. Haines, civilian flight test engineer.

rett, navigator, and Captain Gerald R. Williamson, DSO. It had been hoped to maintain an average speed of 1000 m.p.h., but bad weather caused too much delay during five subsonic refuelings.

It must be emphasized that all these flights were exceptional in that all of them involved supersonic velocities over considerable periods of time. By contrast, most flying with the Hustler, even today, is at subsonic cruise speed of Mach 0.91, and not all flights include a supersonic leg. The layman cannot conceive of the strain on the aircrew, isolated from each other, with no "opposite number" to spell them as in larger aircraft, and required to maintain for hours at a time the highest degree of alertness; nor the punishment inflicted on the aircraft, its structure heated too hot to touch by air friction, while the four ravenous J-79 turbojets gulp fuel at the rate of 1100 pounds per minute.

To complete the tale of official Hustler records, there was the flight by an Edwards AFB test crew to an altitude of 85,360.84 feet — the greatest height attained by the supersonic bomber in pub-

TB-58A trainer, BOOMERANG.



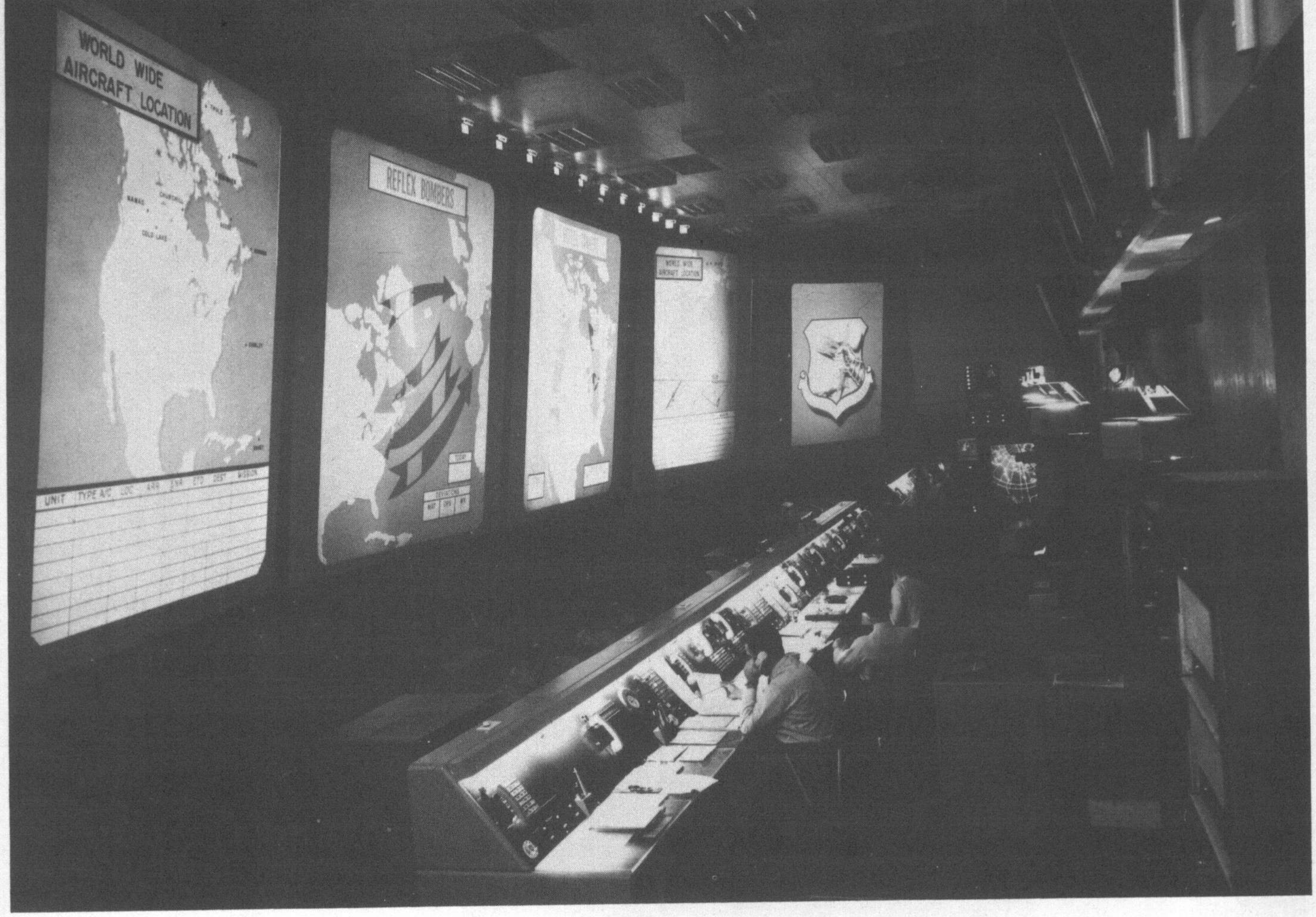
Headquarters, 43rd Bombardment Wing, Little Rock.

lished reports — with a 5000 kg. payload. This height was not achieved in level flight, but by accelerating to Mach 2 at 44,000 feet, and then ascending in a 35-degree climb until the aircraft would go no further.

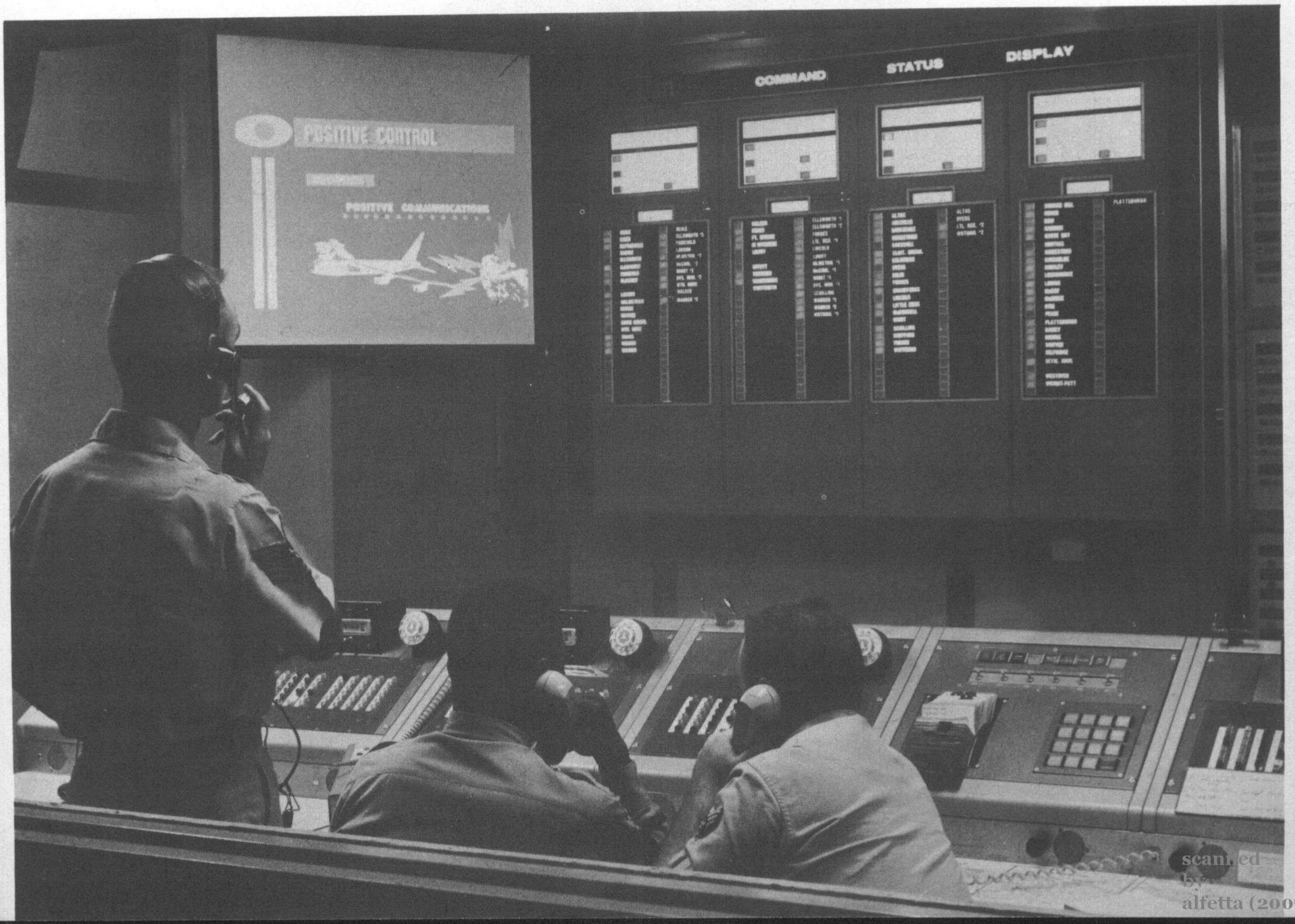
Yet during the months of dramatic record-breaking, the B-58 still was not entirely capable of playing its part in the SAC alert force. Under the principle of "concurrence," evolved at this time for bringing complicated missiles to operational readiness, the bombers of the 43rd at Carswell, like puppies still nursing at their mother, remained attached to the General Dynamic factory on the other side of the field. Devoted and unremitting effort by company and Air Force technicians resolved one nagging systems problem after another. Gradually, escape capsules were installed in all aircraft. At last, when Russian intransigeance in the fall of 1962 brought the United States to the brink of World War III, the 43rd and 305th were ready. "The Cuban crisis did a great deal for us. We went on alert and fulfilled our mission, and have been fulfilling it ever since."

The 43rd Bombardment Wing under Col. Howard J. Fry, USAF, consists of a Headquarters squadron, the 63rd, 64th and 65th Bomb Squadrons, the 70th Air Refueling Squadron (equipped with Boeing KC-135 Stratotankers), the 43rd Organizational Maintenance Squadron, the 43rd Armament and Electronics Maintenance Squadron, the 43rd Field Maintenance Squadron, and the 27th Munitions Maintenance Squadron. The 305th Bombardment Wing under Col. G. W. Johnson, USAF, comprises the 364th, 365th, and 366th Bomb Squadrons, the 68th Air Refueling Squadron (likewise equipped with KC-135s), the 305th Combat Support Group and 827th Medical Group. Despite their geographical separation, both Wings have the same mission of maintaining "capability to conduct strategic air warfare and related operations upon the directive of Headquarters 825th Strategic Aerospace Division, Little Rock AFB, Arkansas; Second Air Force, Barksdale AFB, Louisiana; and Strategic Air Command."

Headquarters, Strategic Air Command, Omaha.


WORLD WIDE AIRCRAFT LOCATION
UNIT TYPE A/C LOC ARR ETA ETD DEST MISSION
REFLEX BOMBERS
WORLD WIDE AIRCRAFT LOCATION

ABOVE: Under fifty feet of earth and concrete, the never-ending watch. BELOW: Working the Green Pine net.



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At 7½ second intervals, "it has to be seen to be believed."

Little Rock and Bunker Hill AFB are only two of the 70-odd SAC bases—mostly within the continental United States, a few still overseas — which house the bombers and the missiles on which the continued survival of the Free World ultimately depends. From the command balcony overlooking the large control room under nearly 50 feet of earth and concrete beneath SAC Headquarters at Offutt AFB, Nebraska, the Commander in Chief of Strategic Air Command can, via the "red telephone," give order to all SAC bases via the Primary Alert System. In case of a threatened attack, he can within a few minutes send all his bombers on the ground towards their "positive control line" outside enemy territory. The back-up for the Primary Alert System is the "Fast Talk" radio network for communication with other SAC bases. Even more impressive is the radio net that keeps him in constant touch with the bombers aloft. "Short Order," a high-powered, high-frequency, single-side-band system, broadcasting from Offutt AFB and from the numbered Air Force headquarters at March, Barksdale and Westover AFB, is designed primarily for control of the airborne force. "Short Order" is the means whereby, in case of war, the "go" code will be transmitted by voice code to the bombers at the positive control line by order of the President of the United States. And to transmit orders to bombers in high latitudes where the aurora borealis may disrupt the "Short Order" system, SAC has the use of fourteen civilian and Navy-manned ultra-high-frequency stations around the Arctic Circle. I stood by the side of Major Goldfogle, the Communications Staff Officer of the Communications and Electronics Division, while he called up all fourteen "Green Pine" stations in the space of not more than three minutes:

"Adak, this is Drop Kick. How do you read me?"

"Drop Kick, this is Adak. I read you five-by-five."

"Thank you, Adak, and out."

And so it went, to Point Barrow, Cold Bay, Argentia, Annette Island, Barter Island, Cape Dyer, Cape Parry, Dye 3, Hall Lake, Hopedale, Keflavik, Cambridge Bay, and Thule. Through Thule, Major Goldfogle obtained a short count from a B-52 flying over Greenland. And a tour of a LOOKING GLASS EC-135C Boeing Stratotanker aircraft — modified to receive as well as to deliver fuel, and filled with electronic equipment—reminded me that even if SAC Headquarters were bombed out, a General and a staff of sixteen communications, operations, plans and material specialists are constantly in the air, ready to dispatch the bombers and missiles via the "Fast Talk," "Short Order" and "Green Pine" radio systems. In an emergency, Second, Eighth and Fifteenth Air Force Headquarters can send up similar airborne command posts with linking aircraft to form a complete airborne command network.

Four throttles in MAX A/B.

Today the 43rd Bomb Wing and the 305th Bomb Wing are each composed of approximately seventy trained crews of three men each, forty B-58 bomber aircraft, and three of the TB-58A trainer aircraft, converted bombers of the first test batch with a second, fully-equipped pilot's cockpit replacing the bombardier/navigator's position. At all times fifty per cent of the bombers of each Wing are standing alert. Due to their relatively low fuel capacity, no B-58s fly airborne alert as do the larger B-52s, but with MITO (Minimum Interval Take-Off) it is possible for each Wing to get all its alert craft airborne within the expected 15-minute warning time available through the Ballistic Missile Early Warning System. A MITO takeoff, with bombers chasing each other down the runway at speeds up to 200 m.p.h., bouncing in the turbulent jet blast of the aircraft ahead, and with visibility obscured by swirling clouds of black smoke from burning jet fuel, must be seen to be believed. Originally taking off at 15-second intervals (still true of the giant B-52s), the

The B-52, able to stand airborne alert.

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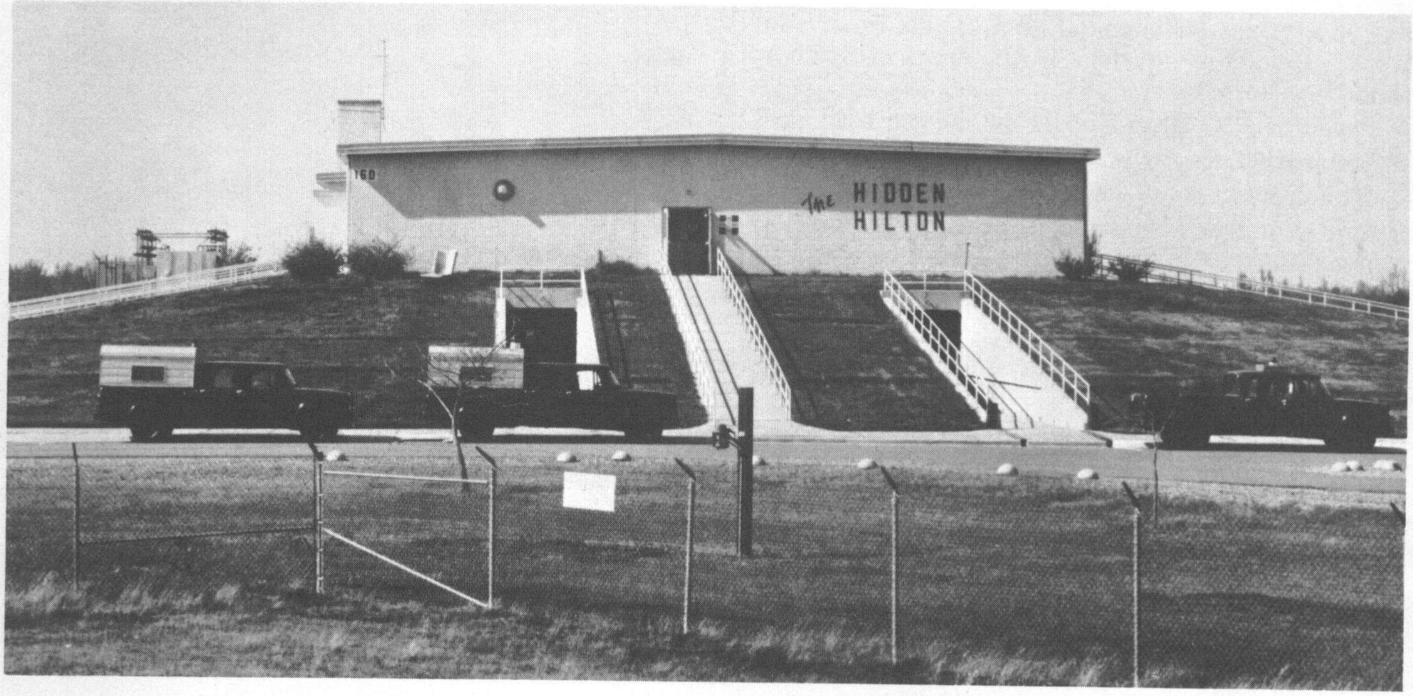
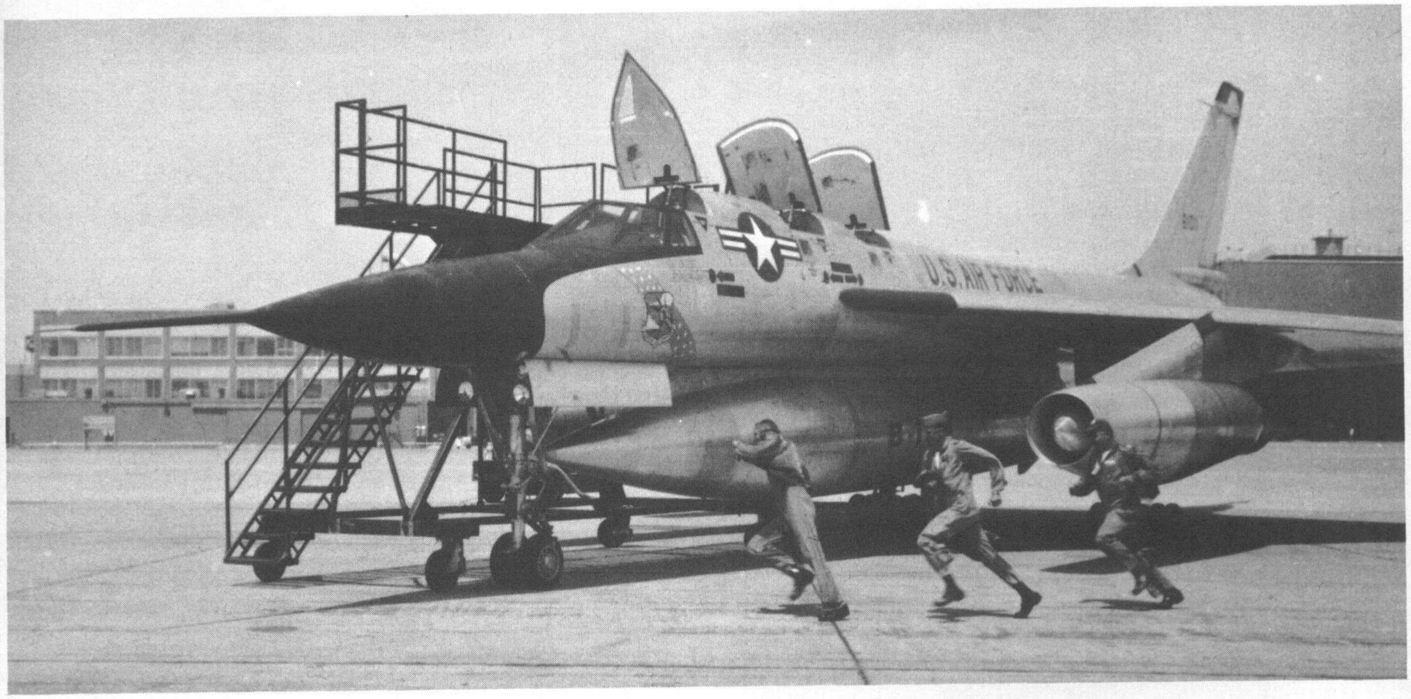


Every third week.

smaller Hustlers now get off twice as fast, at 7½ second intervals, by alternately using the right and left sides of the runway.

The alert schedule places each crew on a seven-day alert tour every three weeks. Theirs is a restricted existence, though they are not confined to the alert barracks (grandiloquently titled "The Hidden Hilton" at Little Rock, and more vulgarly referred to as "The Mole Hole" at Bunker Hill). With the three men of each crew traveling together as a group, and ground transportation immediately on call, they may attend functions on the base—always prepared to race immediately to their aircraft standing "cocked" and ready with weapon pod slung beneath. Thus, many attend the weekly "safety luncheons" and other meetings at Little Rock in their light green flight coveralls with the colorful shoulder patches, presenting a Hustler silhouette

Cocked, with weapon slung beneath.



A test in reaction time.

against a shield bearing the national colors, and listing the Wing's trophies — "Bendix," "Thompson," "Bleriot," "Mackay," "Harmon." Once each tour a no-notice "scramble" sends the crews racing to their planes to test their reaction time. Each exercise they treat as the real thing. They cannot afford to be careless with the security of the United States in their hands.

The alert mission, vital as it is, imposes certain restrictions on another important responsibility, that of each Wing and Squadron commander to keep his men trained to a razor-edge of keeness. The limiting factor here is aircraft availability. The alert aircraft cannot be used for training — "in effect, a SAC wing's alert force is detached from its parent wing and assigned to SAC headquarters."[9]

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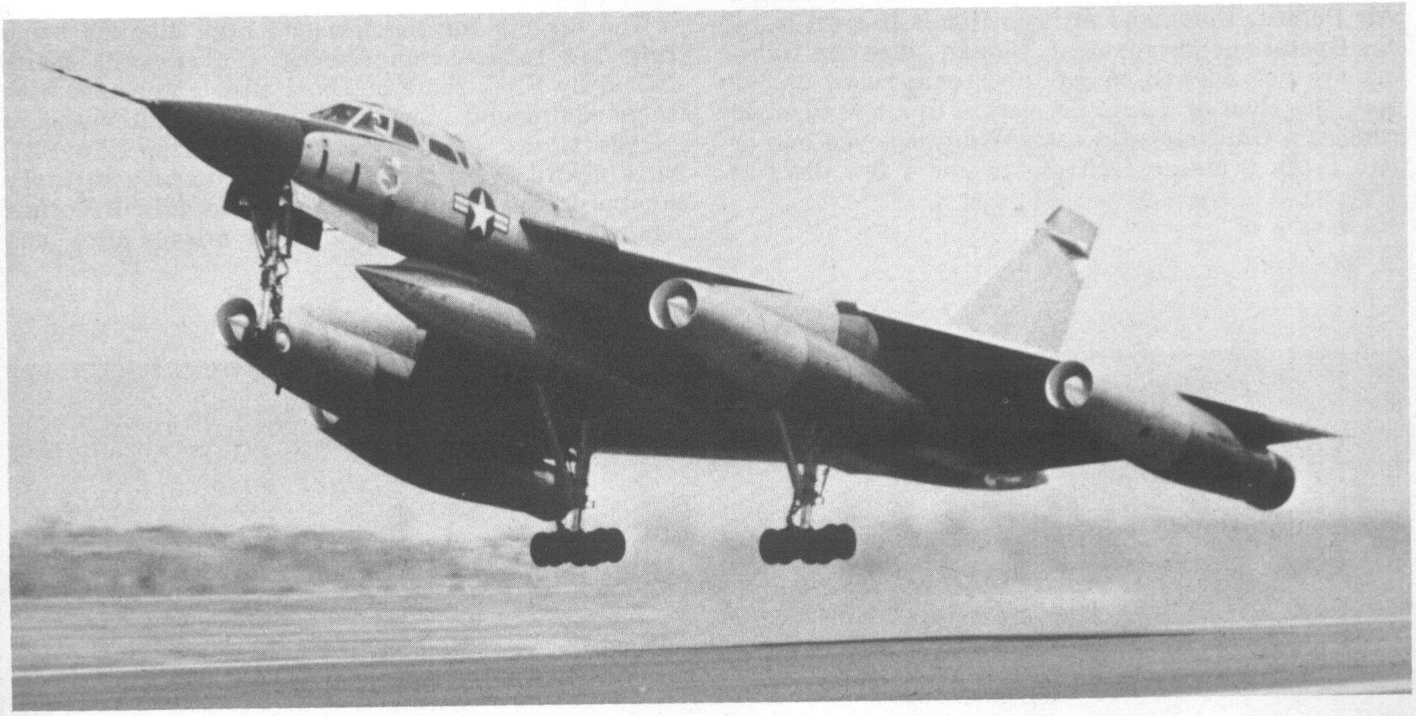
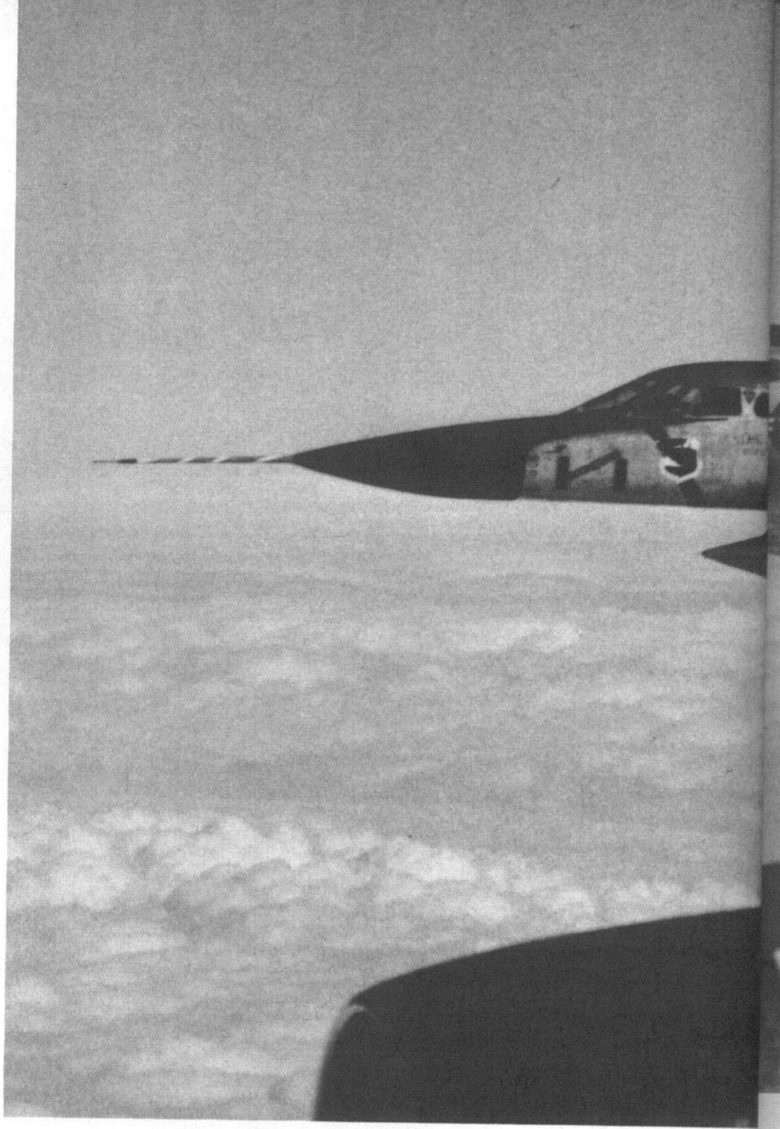
[9] Don Smith, "B-58 Wing Operations," *Air University Review*, v. XV, #6, Sept.-Oct. 1964, p. 62.

Carelessness cannot be afforded.





The others, taking into account normal servicing, repair of in-flight write-ups, technical order compliance and scheduled inspections, average one sortie every two days. Major modification programs may also detract periodically from aircraft availability. In a guarded, amphitheater-like room the Chief of Maintenance Control displays on large illuminated panels lining the walls the maintenance condition of each B-58 and TB-58A in the Wing. Roughly ten of the Wing's aircraft will be available each day for training flights.

Each B-58 pilot averages 3 sorties per month. The entire crew (the navigator does not fly in the TB-58A) average 2 sorties per month. Further training time is accumulated in simulators. Scheduling the more than 200 men of the 70-odd crews for monthly training is the job of the wing deputy commander for operations. His schedule of training flights is drawn up six months in advance, revised in more detail at three months and one month, and on the Thursday before the scheduled week is printed in a small stapled volume listing "specific crews, aircraft tail numbers, take-off times, call signs, and every other detail of the week's flying."[10]

The training operations are designed to simulate as far as possible the crews' assigned EWO (Emergency War Order) missions over enemy territory. With one air refueling from one of the Wing's KC-135 jet tankers, the mission lasts seven to eight and a half hours. Most of this is in subsonic cruise speed — Mach 0.91 — including a navigational practice leg, and at least one simulated bomb release. The simulated attack may be at the end of a low-level "penetration" run at 500 feet just under the speed of sound down an FAA-designated corridor ("Oil Burner Route"), or at Mach 2 above 44,000 feet along a supersonic route designated by Headquarters USAF, SAC, and the FAA. "Bootleg" exercises with F-101 and F-102A fighters of the Air Defense Command are sometimes thrown in by the Operations Department, though since the fighters are not allowed to go supersonic below 35,000 feet, the Hustler has to decelerate to allow them to catch up. Until recently each Wing deployed one or two B-58s overseas each month for a few days at a time (REFLEX operations) to bases in England, Spain, Guam or Okinawa.

The targets for the low and high altitude bomb runs are radar bomb scoring (RBS) units maintained by SAC, some at fixed sites and some, with their equipment, moved around the country aboard target trains ("RBS express") bearing the SAC shield and colors, or in trailer vans similarly equipped. Further electronic countermeasures runs against Army Nike ground-to-air missile sites, and

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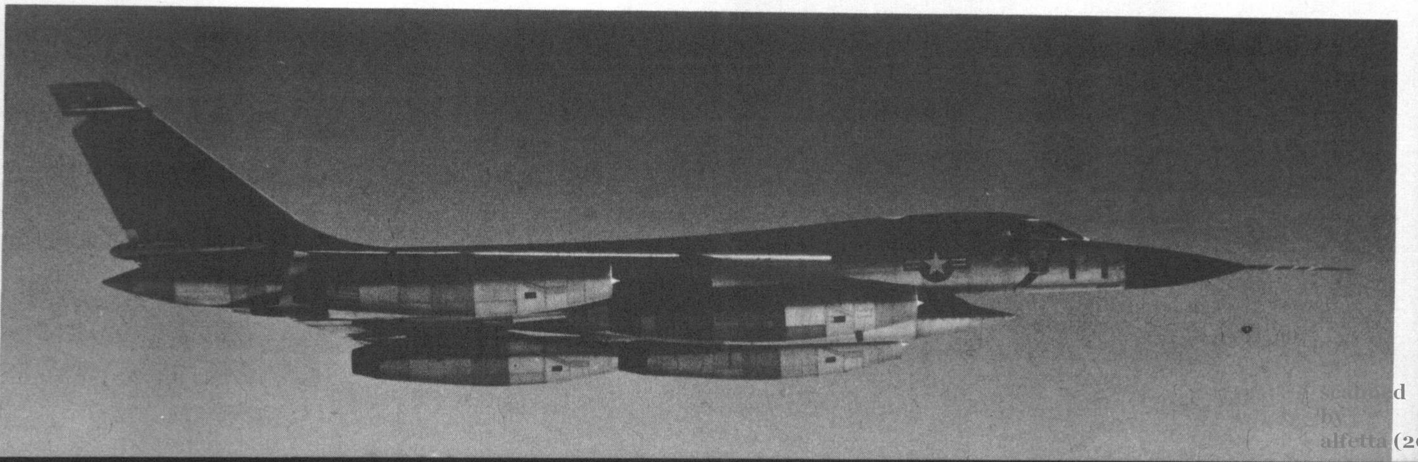
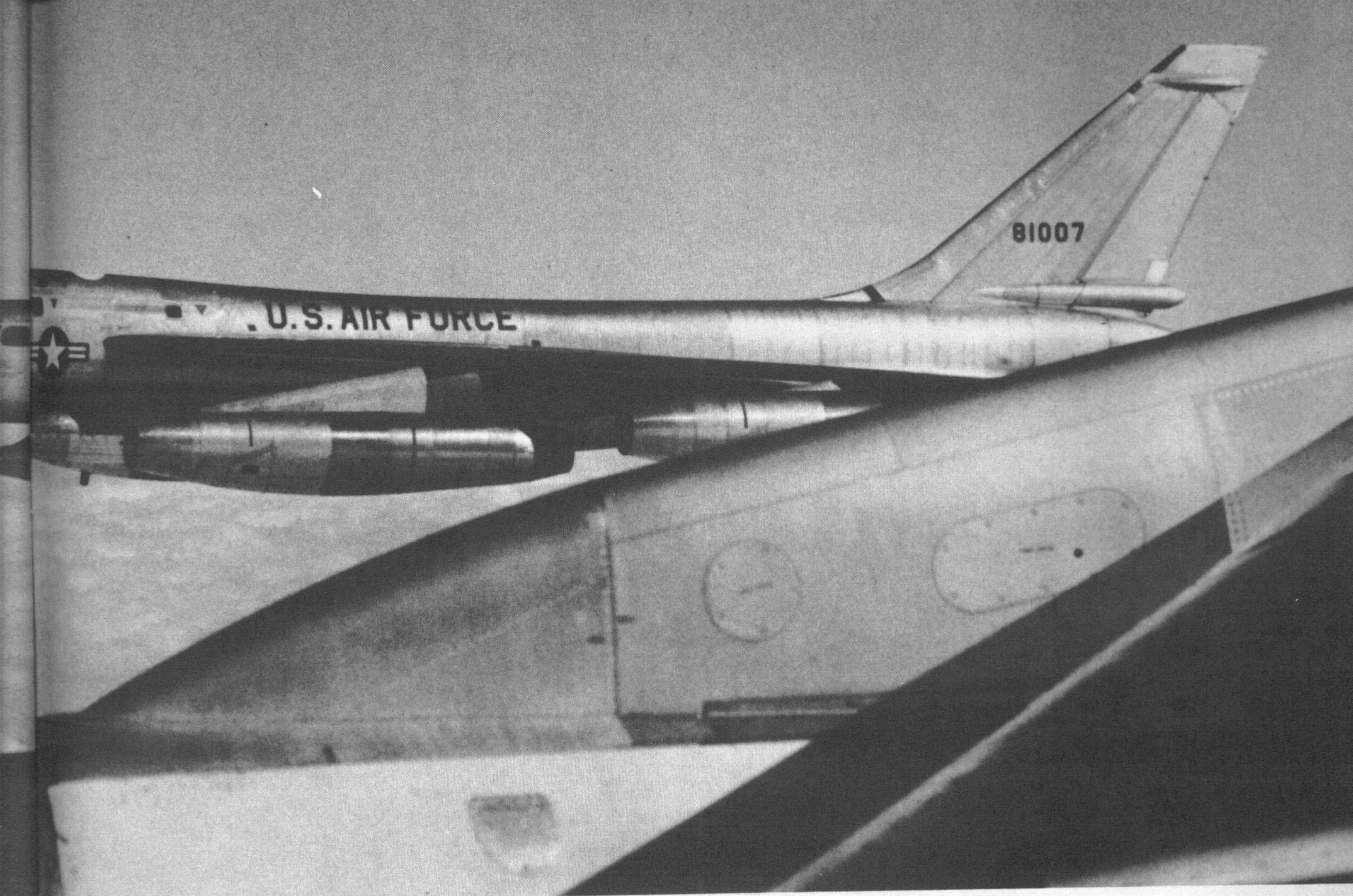
[10] Don Smith, p. 62.

Three sorties a month . . .





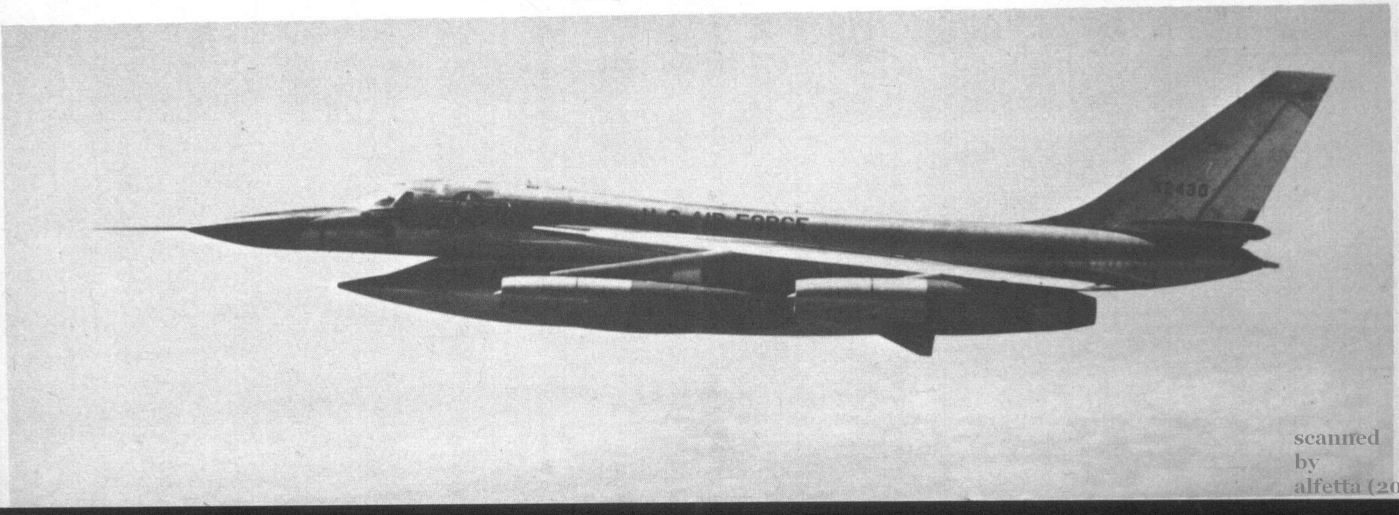
Looking across Number Four pod of a KC-135 tanker at BOOMERANG.

high altitude bomb runs against Nike sites, give practice to Army radar personnel stationed around large cities, as well as to the bomber crews.

Performance of each Wing is checked by SAC Headquarters through the ORI, or Operational Readiness Inspection, an event in which the SAC Inspector General appears without notice and orders a simulated full-scale Emergency War Order strike. In "Bar None" exercises the Wing's aircraft are launched against unfamiliar targets on a strict take-off schedule. The Wing commander is under even closer scrutiny than his men, never being allowed to forget that "there is no difference between an unlucky commander and an ineffective commander: their product is the same."[11] In addition, individual crew performance is frequently checked by the SAC Combat Evaluation Group. Since there is no room aboard the B-58 aircraft for an instructor or evaluation pilot, much of this standardization is done in

[11] Don Smith, p. 63.

along Oil Burner Routes.



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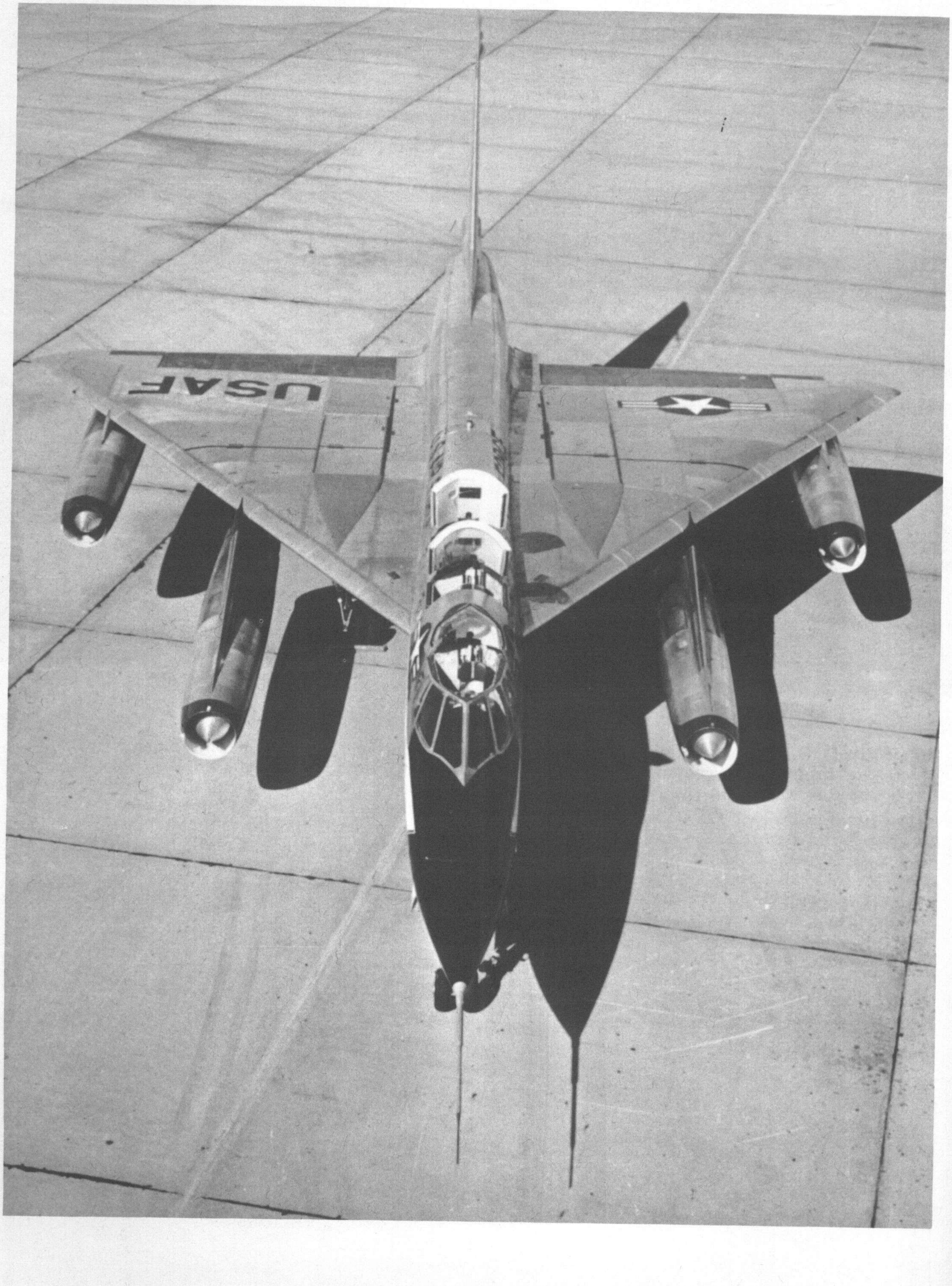
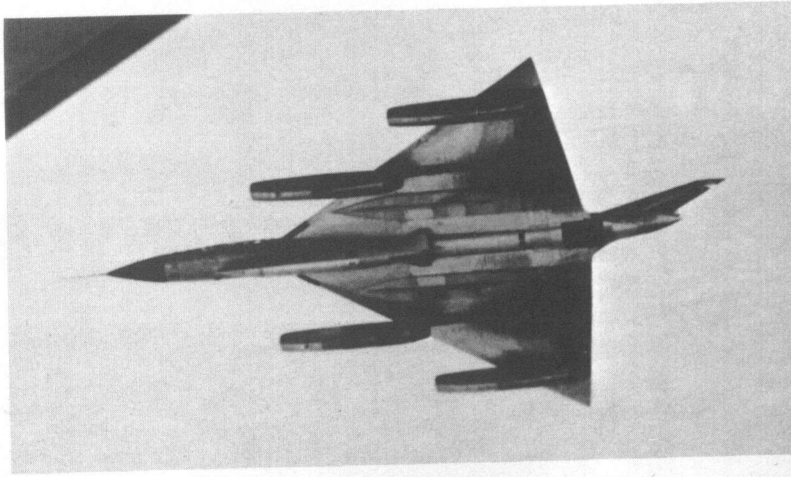

USAF

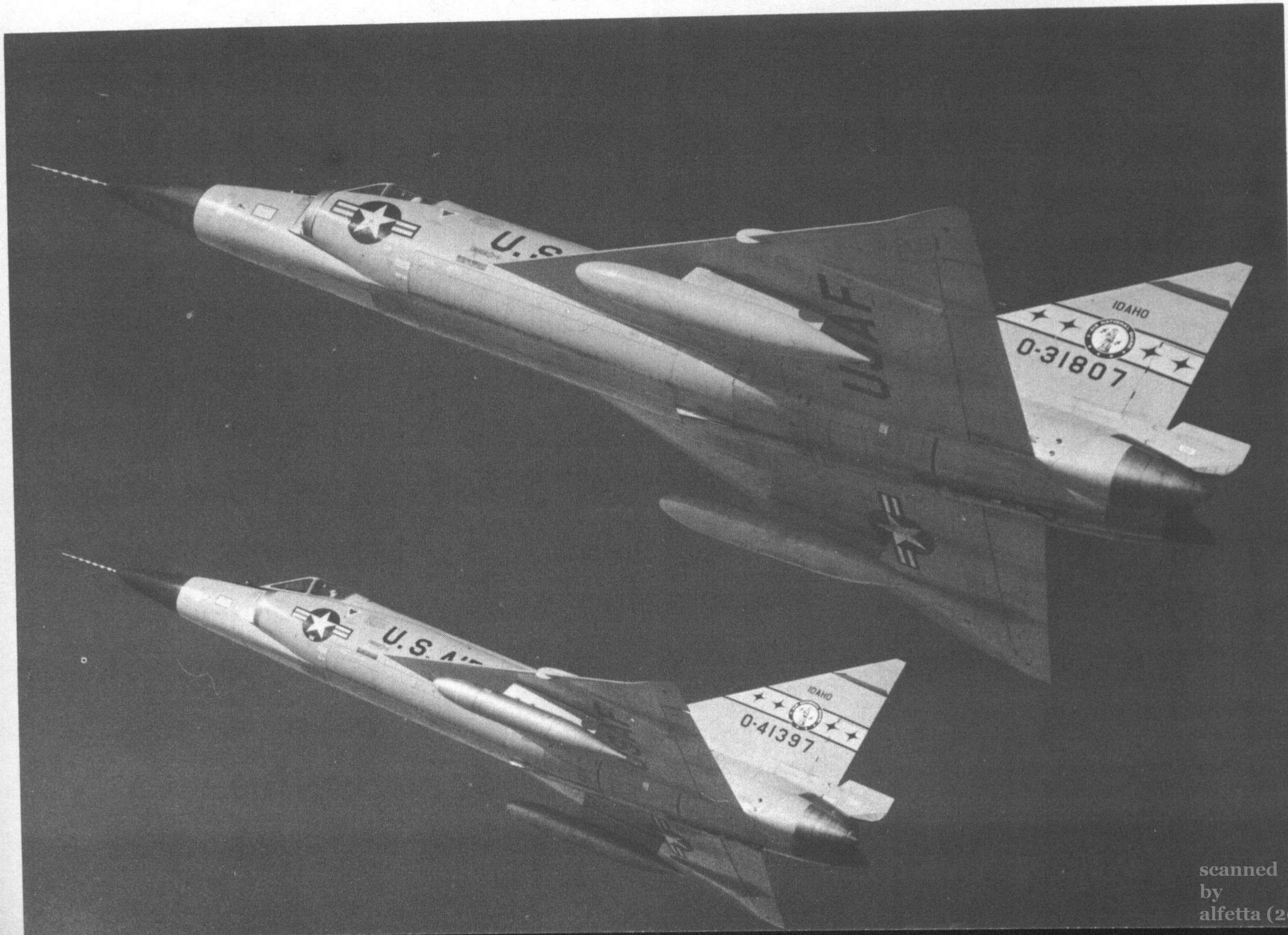
the simulator. Separate simulator cockpits may be used separately or tied together to evaluate the pilot, the bombardier/navigator, and the defense systems operator. All three function realistically: moving radar photographs of the terrain beneath appear on the bombardier/navigator's scope; the DSO sights moving "blips" on the radar screen of his active defense fire control panel; the pilot's simulator not only pitches up and rolls in response to stick movements, but a squeal from beneath the cockpit marks the instant of simulated landing when the tires touch the runway! Realistic malfunctions can be introduced into the working systems by the instructor flipping switches out of sight of the perspiring examinee.

Initial training of B-58 crews is also done on the simulator. Since a duty assignment to one of the B-58 wings lasts three to five years, each Wing maintains a continuous training program, with new crews being assembled every three months. These men are tested, experienced volunteers, formerly selected from lead crews in other Air Force units, and now personally recommended by their former wing commanders. By virtue of the fact that the newest and "hottest" aircraft always represent a challenge to the best men in any air force, the Hustler inevitably attracts a daring, able and ambitious group. Most of the pilots, before entering the program, get several hours' flying time in the F-102A fighter to familiarize themselves with delta-wing handling characteristics. The six-month program involves missions in the simulator, in which the pilot and DSO are linked together almost from the beginning; flights by the pilot and DSO together with an instructor in the TB-58A trainer; and ultimately, solo missions by the entire crew in their own B-58, monitored from the ground by their instructors. The three TB-58As are in constant use, often flying three missions daily.



You learn to fly Hustlers . . .

by flying the F-102A.



LITTLE ROCK AIR FORCE BASE
1502
ALL TRUCKS KEEP RIGHT
STOP
YOU ARE NOW ENTERING THE MOST DANGEROUS AREA IN THE WORLD A PUBLIC HIGHWAY
SLOW DOWN AND LIVE

And they have the figures to prove it.

Unremitting attention to safety, relentless pursuit of operational hazards ("report an incident, prevent an accident"), paid off in a no-accident record for the 43rd Bomb Wing during 1964, and at the end of the year it was nominated for the USAF Flying Safety Plaque and the Colombian Trophy. Lieut. Col. Robert F. Erbe is the Wing's Director of Flying Safety, and presides over weekly "safety luncheons" at which current problems are discussed informally by all air crew members. Credit for the safety record was not his alone — every air crew member, every traffic controller, every crew chief and ground crew man had contributed by conscientious performance of their duty. But it was Colonel Erbe who had kept them safety conscious by inviting their answers to such challenging questions as "what do you think will be the cause of the next fatal crash in this command?" Meanwhile the sign on the main gate proclaims to the departing visitor, "You are now entering the most dangerous area in the world — a public highway"!

One pilot whom I met, Lieut. Col. Charles D. Tubbs, had recently been acclaimed by SAC's Combat Crew magazine as "Pilot of the Month" for having saved his B-58 in the face of unusual systems malfunctions. While flying at 35,000 feet, he

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noted a vibration and the voice warning system came on to tell him that the reservoir tank was not full. Colonel Tubbs declared an emergency, started to descend toward Little Rock AFB, and tried to determine where the fuel loss was occurring. At this time the voice warning system told him that the right fuel manifold pressure was low, and Tubbs shut down the #3 and #4 engines on that side. The apparent loss of fuel was subsequently traced to #4 engine. Shortly thereafter, with no primary hydraulic system or yaw damper operating due to shutdown of #3 and #4 engines, #2 began to run erratically. With only one engine running normally, Tubbs and his crew would have to eject, but he succeeded in getting an air start on #3 engine and landing his B-58 successfully. "Knowledge of aircraft systems, demonstrated by (then) Major Tubbs during this in-flight emergency, allowed him to analyze and correct malfunctions not completely covered in existing directives. His ability to accomplish engine start in the time available and under adverse conditions demonstrates a high degree of proficiency, and resulted in saving a multi-million-dollar aircraft for the Strategic Air Command."[12]

It was with sorrow and regret that I learned a few months later, on June 15, 1965, that Colonel Tubbs had died when his Hustler, en route to the Paris Air Show, crashed short of the runway at Le Bourget airport after a flight from Little Rock via Torrejon AFB, Spain. The accident was tragically reminiscent of the deaths of Major Murphy and the Bleriot Trophy crew at the Paris Air Show four years before.

In one respect the B-58 wings are fighting a battle the outcome of which is in some doubt — against the adverse public reaction to the "sonic boom." Brochures bearing a sketch of the B-58 insist that "sonic booms are not caused by 'aerial hot-rodders' at play, but by mature, dedicated air crews seriously studying their wartime jobs. The better these men are prepared to do their jobs in time of war, the stronger is this nation's deterrent force — the force that prevents any other country from attacking the United States."[13] The citizenry will, it is hoped, accept the sonic boom as "the

"Can do!"

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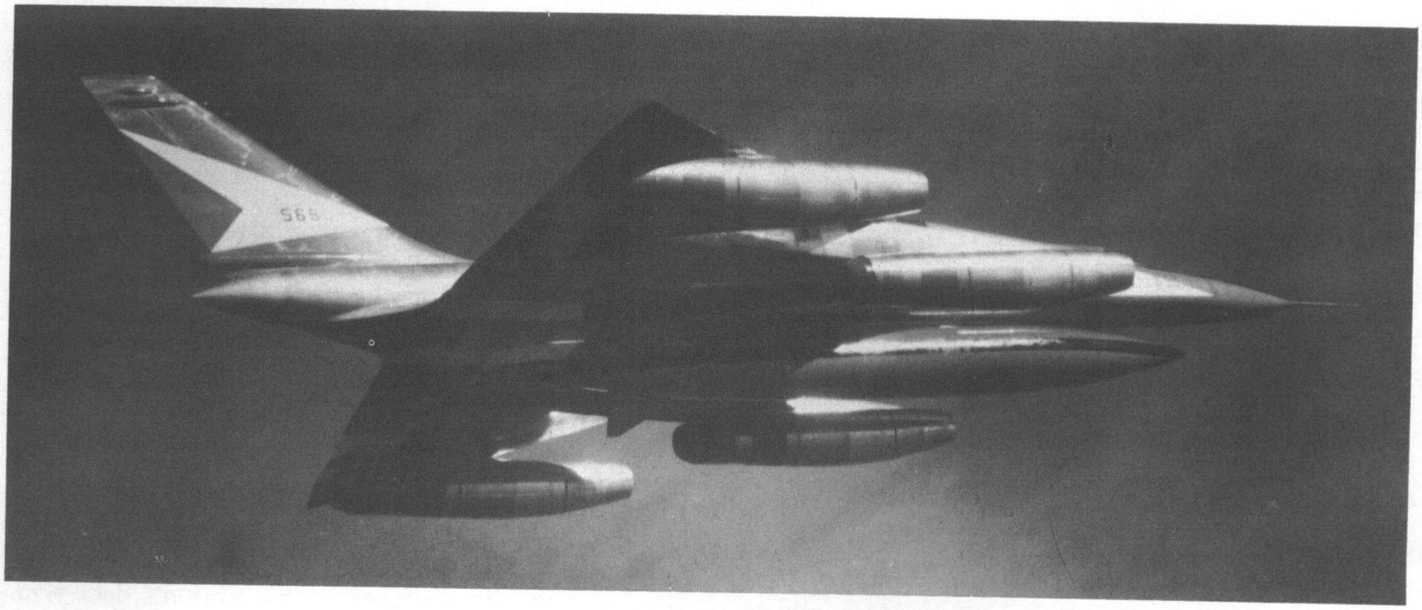
[12] *Combat Crew*, November, 1964, p. 27.

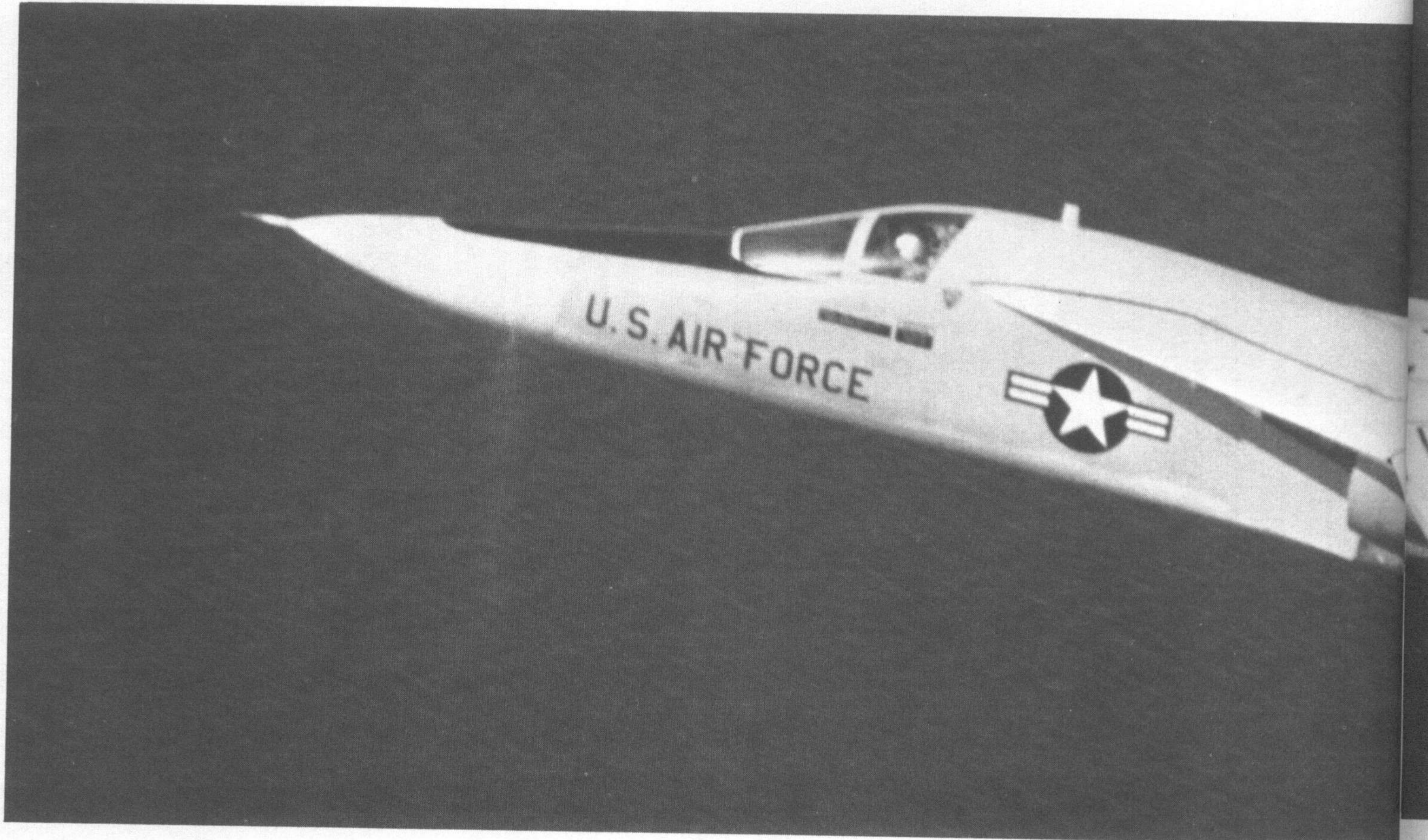
[13] Pamphlet, "The Sonic Boom." Prepared for Office of Information, 3092nd Air Base Wing (SAC), Offutt AFB, Nebraska.

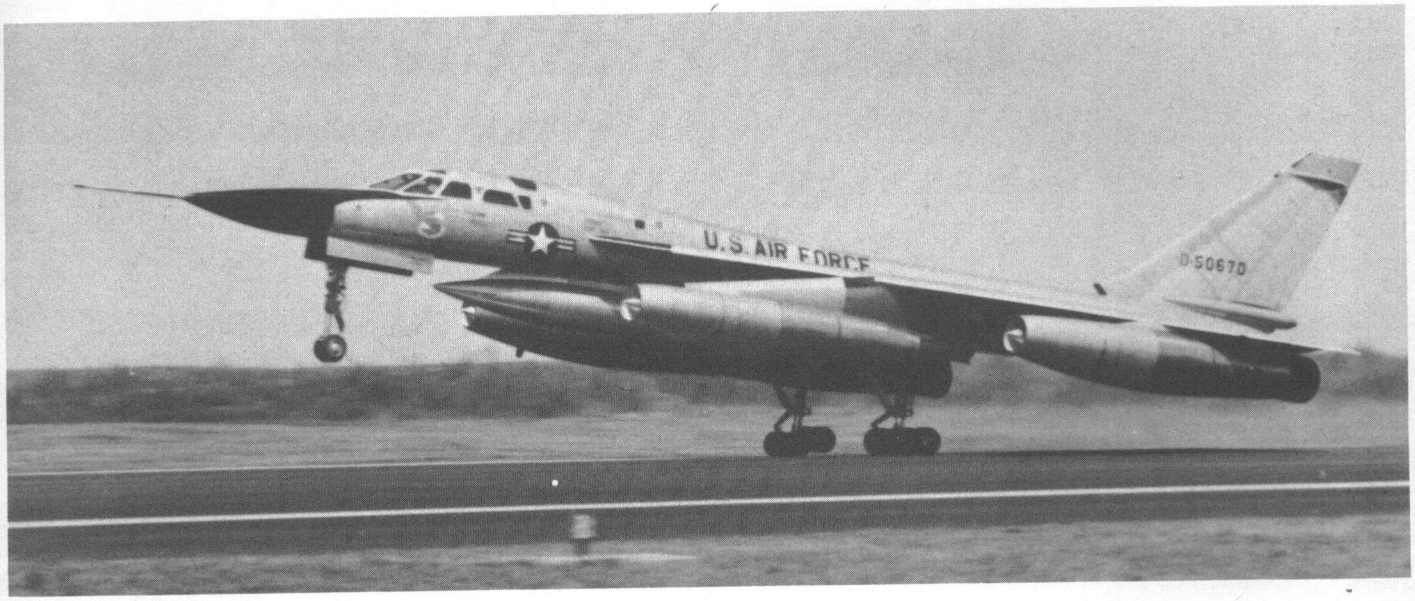


After 100,000 hours . . .

sound of freedom" when emanating from military aircraft, but may not show the same tolerance for the supersonic transport.

And so, night and day, the B-58 Hustlers of the 43rd and 305th Bomb Wings go on flying their training missions to be prepared on instant notice to wage strategic air war against any aggressor on order of the President of the United States. On March 12, 1965, they completed 100,000 hours in the air. This included (as of February 28, 1965) 1644.4 hours at supersonic speed, and 456.8 hours at Mach 2.

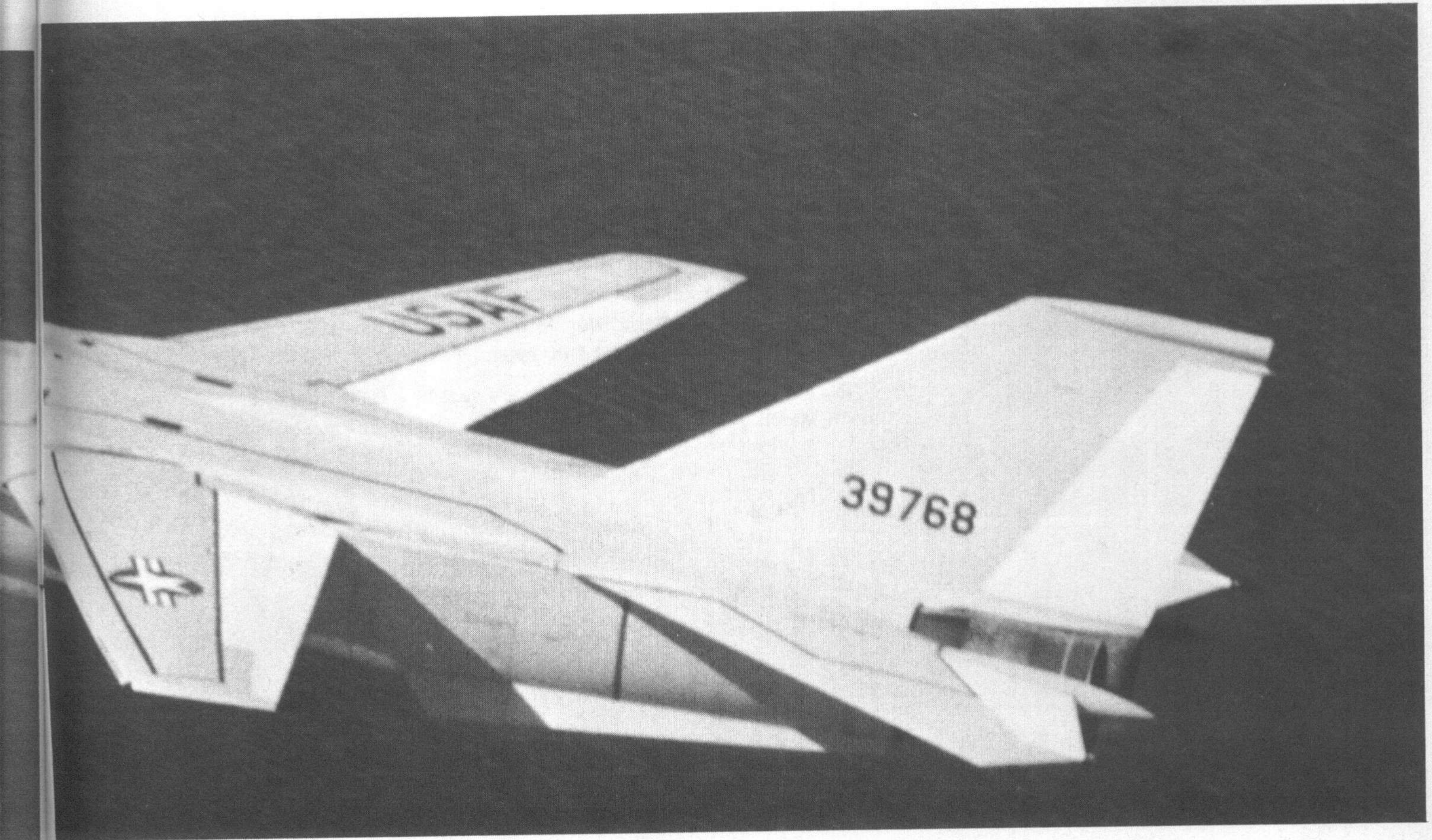




the curtain may be falling.

Will the sleek Hustler, so swift in high altitude strikes, so elusive in penetration missions on the deck, be the last of the manned bombers? I join with the many authorities more knowledgeable than myself who see an indispensable role for years to come for the manned bomber in the missile age. A worthy successor to the B-58 has just rolled out at the General Dynamics plant in Fort Worth — the variable—swept-wing F-111 two-place fighter with a maximum speed of Mach 2.5. Hopefully, with certain modifications, this could be the Hustler's successor and the manned bomber of the '70s.

A worthy successor?



About the Author . . .

Douglas Robinson's interest in aeronautics stems from the day the airship "Shenandoah" flew over his home in Massachusetts when he was five years old. Today he is an internationally recognized authority in the lighter-than-air field. His translation of Dr. Hugo Eckner's "My Zeppelins" was published in 1958; his own "The Zeppelin in Combat," a comprehensive history of German airship operations in World War I, was published in 1962. He also wrote "LZ-129 Hindenburg," published in 1964.

Dr. Robinson, seen here in the pilot's seat of a B-58 Hustler at Little Rock AFB on March 7, 1965, is currently writing a history of aviation medicine.

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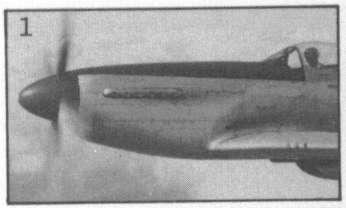
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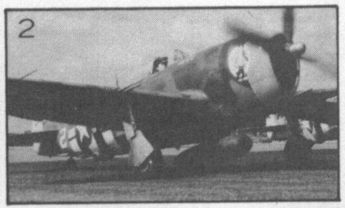
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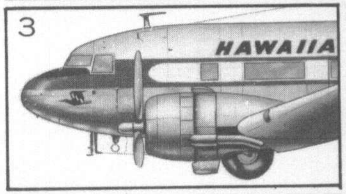
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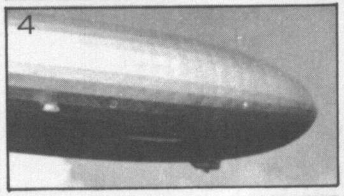
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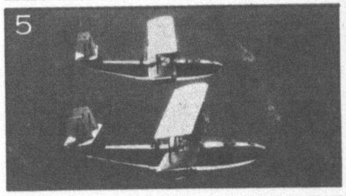
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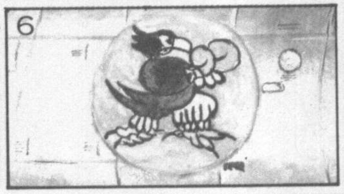
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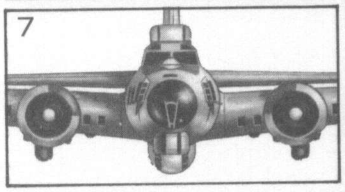
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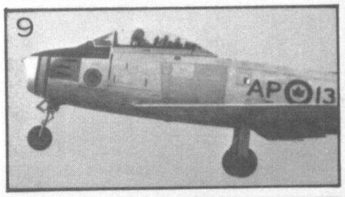
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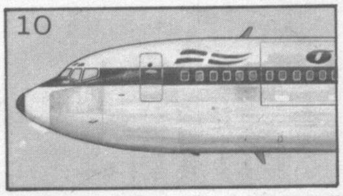
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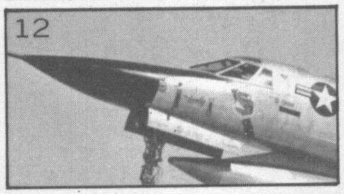
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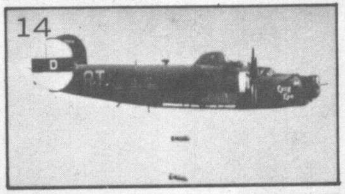
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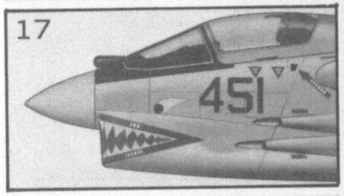
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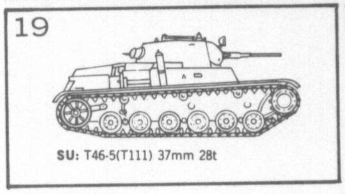
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